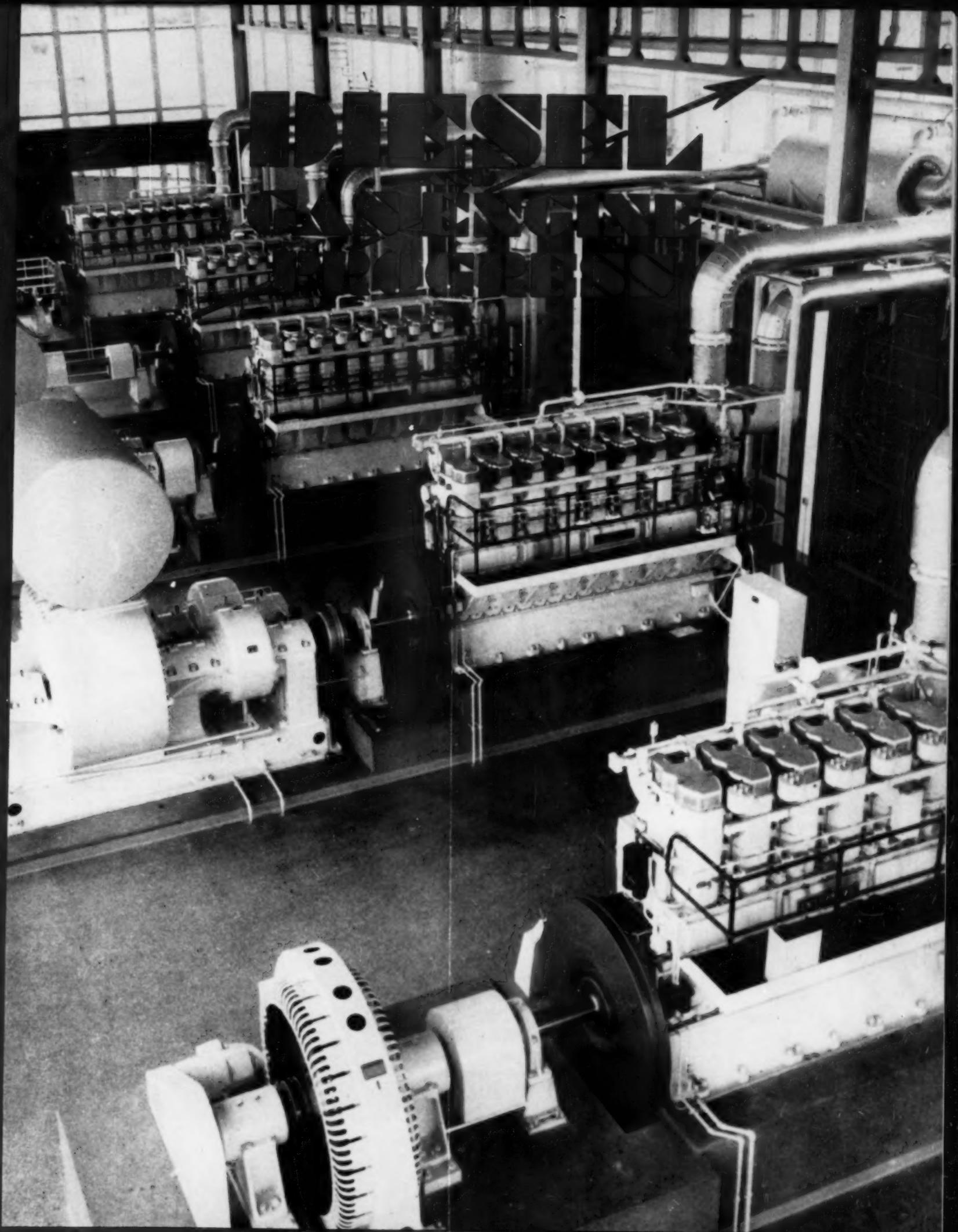


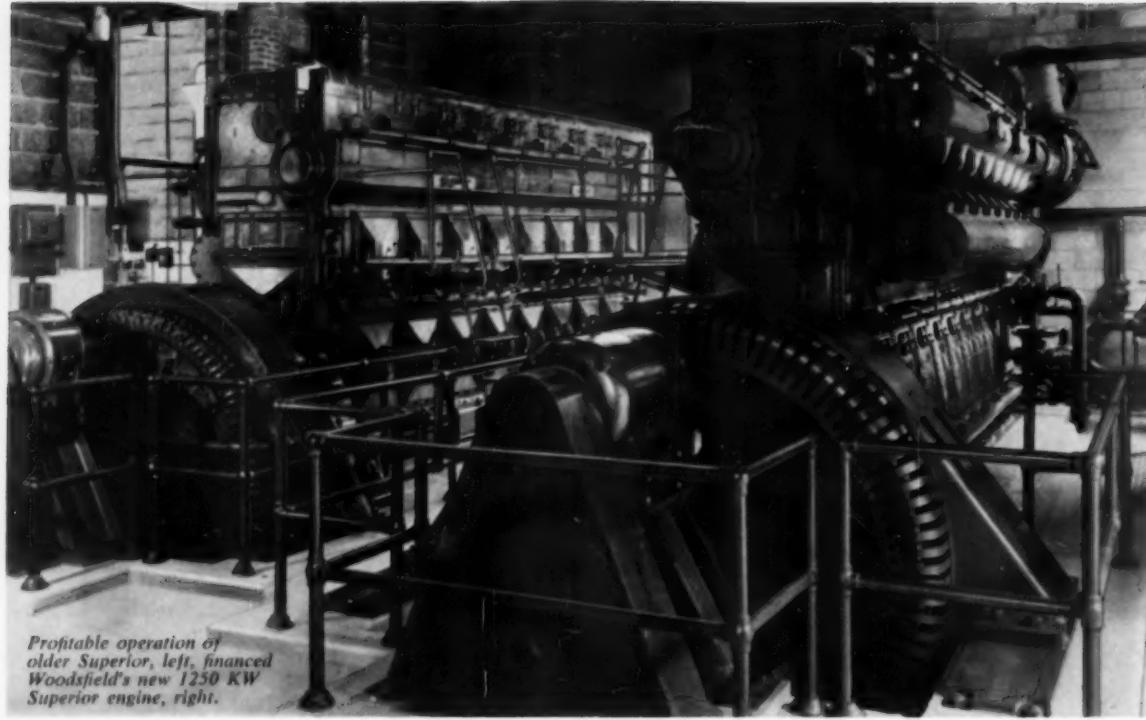
DIESEL ENGINES • DUAL FUEL ENGINES • NATURAL GAS ENGINES • GAS TURBINES



FIVE DOLLARS PER YEAR

DECEMBER, 1959

FIFTY CENTS PER COPY



*Profitable operation of
older Superior, left, financed
Woodsfield's new 1250 KW
Superior engine, right.*

80-GDS-8 runs 44,000 hours without overhaul, cuts fuel cost 50%, pays for second diesel!

Olin Mathieson's new aluminum plant on the Ohio River, 18 miles from Woodsfield, caused the town to grow more during 1957-59 than in the previous 25 years combined! Power consumption soared from 2,921,740 KW in 1956 to 4,167,260 KW in 1958, as acres of new worker homes hit the line.

But economy-minded city fathers and maintenance-conscious power plant personnel met the crisis, aided by two Superior engines. The first, an 80-GDS-8 dual-fuel of 600 KW capacity, entered service in 1950. During the next 7 years, it reduced costs per KWH 50% as compared to Woodsfield's 3 older straight diesels. After 44,000 hours operation, it was overhauled in 1958. The only replacements needed were connecting rod bearings. Piston rings were replaced, too, although their .002" wear was well within tolerances.

This Superior did more than supply consumers with low-cost electricity. Power profits also financed various municipal improvements, including a second Superior engine-generator! The new 80-GDSX-8 supercharged dual-fuel of 1250 KW capacity commenced operation in early 1958. In addition to maintaining low fuel costs, it operates more than 50,000 horsepower-hours per gallon of lube oil!

For every municipal need, White Superior offers economical diesel, dual-fuel, or gas engines ranging from 190 to 2150 HP, or 150 to 1500 KW!

Superior engines power Woodsfield's boom!



White Diesel

WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY

Plant and General Offices: Springfield, Ohio

L. W. Marple, plant superintendent, checks controls
of town's five power-producing engines.



SPICER RUBBER ELEMENT SHAFTS CAN HELP YOU SOLVE YOUR TORSIONAL RESONANCE PROBLEMS

If you are faced with the problem of torsional vibration from impulses within the operating range, Dana engineers may be able to help you solve your design problems.

Spicer resilient propeller shaft assemblies have been used successfully for years in rapid transit cars, street cars, engine dynamometer, truck, bus, earthmover and passenger car applications to solve difficult torsional problems.

Spicer rubber-cushioned shafts make it possible for design engineers to "tune out" the vibration and thus produce commercially acceptable installations.

Spicer rubber-cushioned propeller shafts offer these additional advantages:

- 1** The torsional flexibility limits the effect of high impact loads resulting from rough shifts and other sudden torque changes.
- 2** The cushioning effect prevents clatter, rattle, and backlash noises.
- 3** Increased life of bearings, gear teeth, splines, and other components due to the reduction of high impact and torsional loads.
- 4** Reduction of noise transfer.
- 5** Axial flexibility to cushion forces resulting from length changes.

Product knowledge and years of experience are available to you through Dana engineers to help solve your torsional problems. Contact them today.



International 295 Payloader, equipped with a Spicer rubber element shaft, at work on the Interstate Highway System.



DANA
CORPORATION

Toledo 1, Ohio

SERVING TRANSPORTATION—Transmissions
Auxiliaries • Universal Joints • Clutches • Propeller
Shafts • Power Take-Offs • Torque Converters
Povr-Lok Differentials • Gear Boxes • Forgings
Axles • Stampings • Frames • Railway Drives

Many of these products are manufactured in Canada by Hayes Steel Products Limited, Merrilton, Ontario

General Motors Reliability in Action...

Freeways of the Future!



Harrison Heat Exchangers
—Reliable Products of
General Motors Research
and Engineering.

Harrison Oil Coolers Bulldoze Heat on Giant Diesel-Powered Road Building Equipment!

Mowing down mountains of earth . . . clearing the way for tomorrow's highways . . . and Harrison handles the heat. Great diesel-powered earth movers such as this crawler tractor and scraper depend on Harrison to hold engine oil temperatures steady. Harrison products are backed by the reliability of General Motors research, design and testing. That's why you'll find Harrison heat exchangers on the most advanced aviation, marine and industrial equipment. Remember, too . . . every Harrison heat exchanger is the product of a half century of manufacturing experience . . . your further assurance of *top quality, top reliability!* If you have a cooling problem, look to Harrison for the answer!

GM
HARRISON
TEMPERATURES MADE TO ORDER
AIRCRAFT, AUTOMOTIVE, MARINE AND INDUSTRIAL HEAT EXCHANGERS

HARRISON RADIATOR DIVISION, GENERAL MOTORS CORPORATION, LOCKPORT, NEW YORK

DIESEL AND GAS ENGINE PROGRESS

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Editor and Publisher

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR

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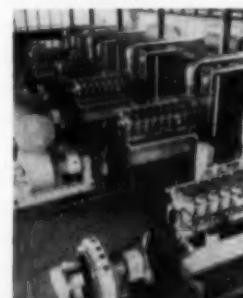
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FRONT COVER ILLUSTRATION

Five Enterprise tri-fuel series G engines, four driving Roots-Commerceville blowers, the fifth a General Electric generator, are installed in the new Toledo, Ohio sewage treatment plant. See page 28 for a report on the new \$9,500,000 plant.



Twin Disc Single-Stage Torque Converter (left) proves its merit in record-breaking ditch cleaning job.

7 CYCLES A MINUTE for torque converter-equipped Marion 35-M Dragline

Canton, Ohio truck farmers recently hired Don Lowe's Dredging & Excavating Co., Loudonville, Ohio, to clean out their drainage ditches. Loose dirt had filtered into the ditches, gradually closing them up and severely reducing their effectiveness.

Almost 10,000 feet of ditches 10 to 12 feet wide needed cleaning, and three feet of muck had to be removed from the bottom of the cuts.

The entire job was done with one machine—a newly purchased Marion Type 35-M Dragline with a one yard bucket. Powered by a Cummins J6B1 Engine, this unit drives through a

Twin Disc Single-Stage Torque Converter. With a 45° swing the dragline completed seven cycles per minute—less than nine seconds per load!

Let Owner-Operator Don Lowe tell why he likes to work with torque converter drive: "The converter really smooths out the cycles. I get exactly the torque I need for digging, hoisting or swinging, and the engine never lugs down. It's a lot faster, and a lot easier to handle too."

Marion and almost every other excavating equipment manufacturer offers the Twin Disc Torque Converter as standard or optional drive. When you specify a Twin Disc Converter in

your crane or shovel, you get the same converter that boosts production and profits in your crawler tractor. It's the best investment you can make when buying heavy-duty machinery. Twin Disc Clutch Company, Racine, Wisconsin; Hydraulic Division, Rockford, Illinois.



TWIN DISC
Torque Converters

engines cooled by Ross Exchangers



six I-R Compressors start natural gas on its trek through Canada's Big Inch

TAYLOR, BRITISH COLUMBIA—It's 35 below zero at Compressor Station No. 1, the starting point for Canada's Big Inch. Only the powerful hum of six 2000 hp Ingersoll-Rand, gas engine driven compressors, cracks the still, sub-arctic air.

Depending on them for 260 MMcf of gas daily are six western states and British Columbia. Since normal operation must continue even when the mercury skids to 50 below, every piece of equipment *has to be* a top performer up here.

Ross Exchangers keep all six engines well supplied with 145° lube oil and jacket water. Noted for their high thermal efficiency and rugged construction, Ross Exchangers are often as not found in critical spots such as this.

Versatile and compact, they meet a wide variety of oil, water, gas and air cooling requirements. Today, Ross Exchangers circle the Earth...possibly one day soon, the moon.

Get complete information on the broad range of sizes, capacities and pass arrangements. See for yourself how Ross pre-engineered and fully standardized exchangers will fit into your requirements. Write for Bulletin 2.1K5. American-Standard* Industrial Division, Detroit 32, Mich. In Canada: American-Standard Products (Canada) Limited, Toronto 4, Ont.



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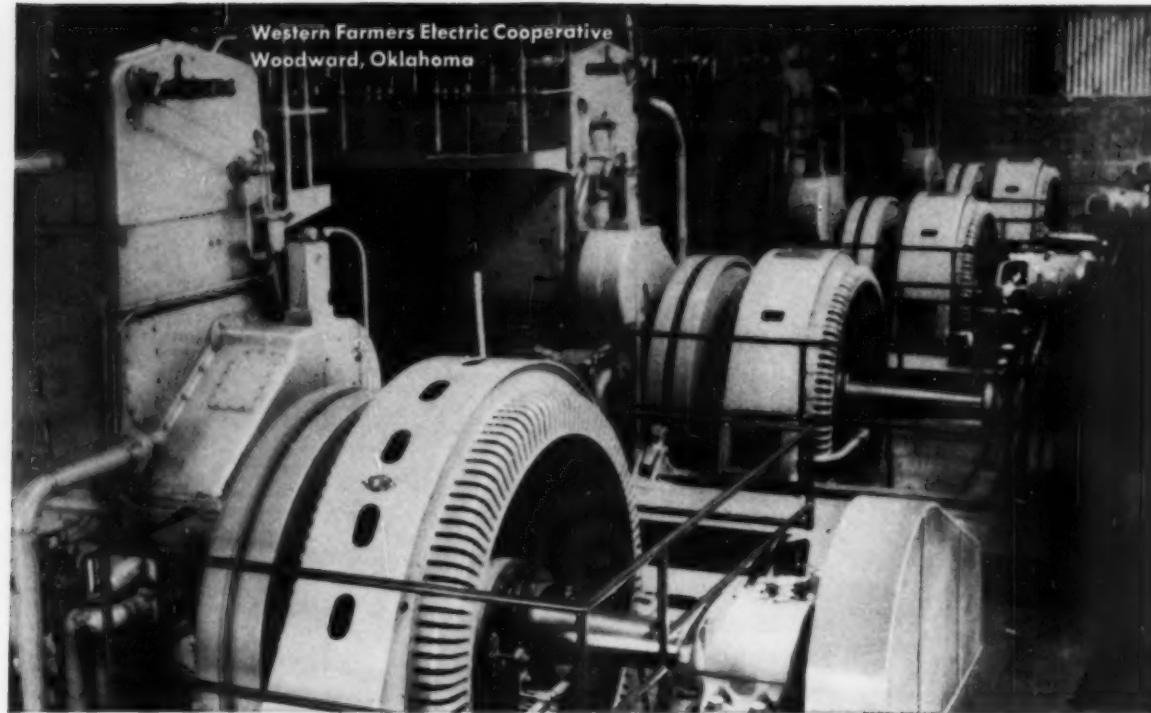


AMERICAN-Standard
INDUSTRIAL DIVISION

AMERICAN BLOWER PRODUCTS

• KEWANEE PRODUCTS

• ROSS PRODUCTS



8 years with same pistons; cylinder wear .005 using Cities Service DC-940 Oil

**Nordberg engines roll up over 44,000 hours
with minimum wear, no lubrication problems.**

Frequently running at 77% of plant capacity, Western Farmers Electric Cooperative is getting newsworthy service from its eight year old Nordberg engines and Cities Service DC-940 Oil.

Three of its four engines have piled up over 44,000 hours each . . . and two of these three still have the original piston rings! Average cylinder wear is .005, and horsepower hours per gallon of lube oil are running as high as 14,000!

Says Plant Superintendent H. P. Wingo: "In the entire eight years we've been using Cities Service DC-940, downtime for maintenance has been almost nonexistent and we've never had a lubrication problem of any kind. Thanks to this kind of performance, we continue to hold one of the highest REA power efficiency ratings."

If you're looking for a lube oil capable of increasing horsepower hours per gallon—an oil properly fortified to prevent oxidation and engine wear—get the facts about Cities Service DC Series Oils. Talk with a Cities Service diesel lubrication specialist from the nearest office. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.



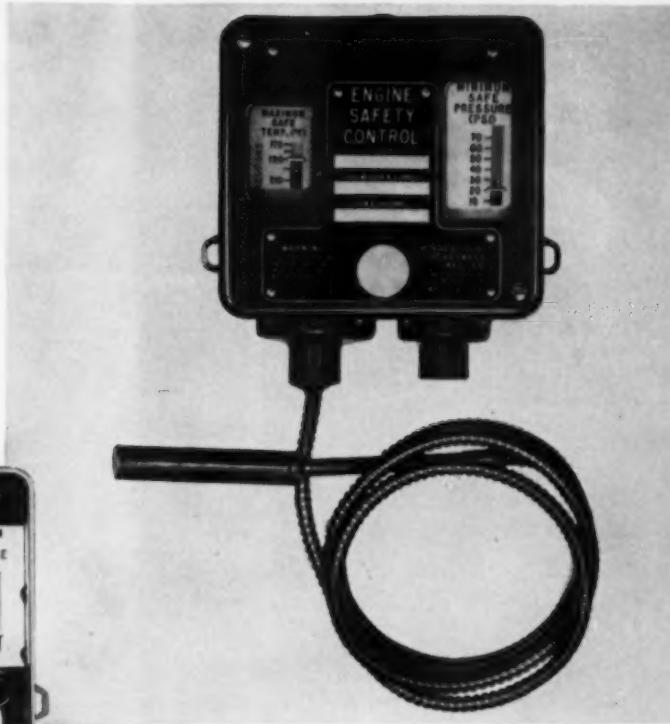
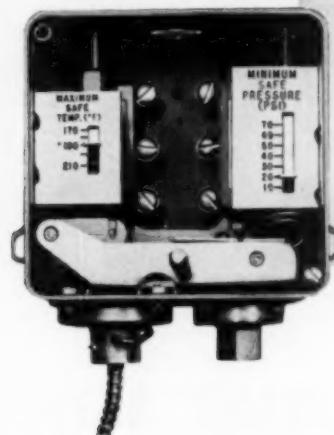
Supt. H. P. Wingo and Assistant Supt. Harold Conley keep Western Farmers Electric Cooperative high among REA power efficiency ratings. Both credit Cities Service with a major assist.



For The Record . . . And What A Record! Often at 77% capacity, Western has operated its Nordbergs for eight years with absolutely no lubrication problems using Cities Service DC-940. 14,000 h.p. hrs. per gallon is common.

CITIES  SERVICE
QUALITY PETROLEUM PRODUCTS

Temperature and pressure set points are inside the case, protected against accidental manipulation. Cover is removed for easy adjustment.



NEW Diesel engine safety switch
...gives fail-safe protection

This all-new Honeywell safety switch responds to abnormal pressure or temperature to stop or idle a diesel engine, or actuate an alarm circuit.

It combines separate systems for measuring engine coolant temperature and lubricating oil pressure. The temperature system includes an exclusive fail-safe feature, so that in case of damage to its temperature bulb, capillary or diaphragm, the switch responds as it would to excessive temperature.

Temperature and pressure settings can't drift off set points. There can be no false shutdowns due to vibration. Set points are easily adjustable in the field.

Your nearby Honeywell field engineer will be glad to give you complete information about the new Diesel Engine Safety Switch. Call him today . . . he's near as your phone.

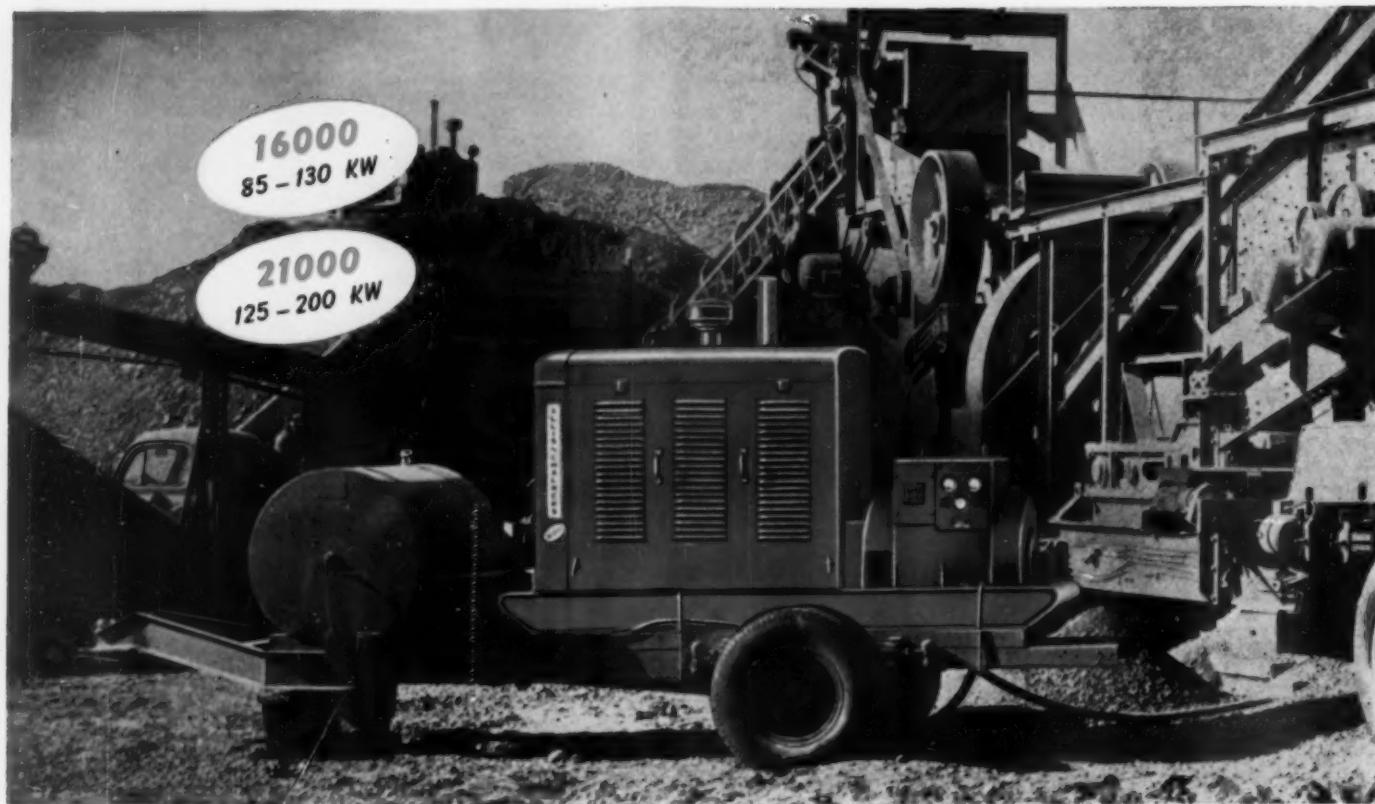
MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell



First in Control

● REFERENCE DATA: Write for Specification sheet S1010-5 "Diesel Engine Safety Switch."



This Allis-Chalmers 16000 diesel generating set provides electric power for motors on a crusher operating near Great Falls, Mont. Primary

power source for the crusher is an Allis-Chalmers 21000 turbocharged diesel power unit, companion to the 16000.

NEW



DIESEL GENERATING SETS WITH BRUSHLESS GENERATORS

... offer 5 big advantages

1. Single manufacturer responsibility

Allis-Chalmers manufactures and stands behind all four major components that comprise these *complete* units — the modern diesels, the proved brushless generators, the rapid-response regulators and the switchgear. This means coordinated engineering, matched performance, undivided responsibility — an Allis-Chalmers exclusive.

2. Fast starts — Fuel savings

The modern diesels, with their unique, controlled combustion, start and pick up loads in 4 to 10 seconds. They save fuel, too. The 21000, for instance, saves 8½ to 27% in fuel over other diesels in its class. That's 1 to 2½ gal. of fuel in every 10!

3. Precisely regulated power

The new Allis-Chalmers magnetic amplifier type static voltage regulator has no moving parts or contacts. No parts to burn or wear. It has unequalled fast response to sudden

changes in load. Precise power regulation protects sensitive apparatus, easily picks up heavy motor starting loads.

4. Brushless generator has new simplicity

There are no slip rings, no brushes, no commutators to wear or to spark. Newly developed, non-aging silicon rectifiers rotate with the armature and replace the slip rings, brushes and commutator. Brushless generators are ideal for operation in dusty areas or in corrosive or explosive atmosphere — provide unequalled electrical reliability.

5. Fast, easy unit installation

These sets are simple, unit-type, self-contained. They are mounted on husky skids — no special foundation is required, no danger of misalignment. Electrical connections are simplified, to speed installation and reduce related costs.

Your Allis-Chalmers dealer can give you complete specs, and assist in determining your needs. Call him or write Allis-Chalmers, Milwaukee 1, Wisconsin.

EG-36

ALLIS-CHALMERS
POWER FOR A GROWING WORLD





Why you need AiResearch turbocharger control systems

The two components of the AiResearch turbocharger control system are a speed sensor and an exhaust by-pass valve. They control the speed of exhaust-driven turbochargers by modulating the amount of engine exhaust used.

The AiResearch turbocharger control system delivers more air to the turbocharged engine automatically when needed. This more than doubles the torque rise and gives the engine much greater lugging ability under heavy loads.

AiResearch is the leader in the development and production of turbocharger controls for all major diesel engine applications as well as air-cooled turbochargers for diesel engines from 50 to 700 H.P. Your inquiries are invited.



- **Reduced fuel consumption**

- **Smoking eliminated**

- **Longer engine life**

- **Lower maintenance costs**

- **Shorter running time**

- **Better engine lugging**

THE GARRETT CORPORATION

AiResearch Industrial Division

9225 South Aviation Blvd., Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND SPECIALIZED INDUSTRIAL PRODUCTS

Increased power, lower fuel consumption

THREE NEW GENERAL MOTORS 567 DIESEL ENGINES

New "D" series available in turbo-charged or normally aspirated models

First application for the new "D" engines was announced recently by Electro-Motive for a new and more powerful, more economical line of Diesel locomotives. Four years in development, two of the new engines are turbo-charged, one normally aspirated.

A long list of improvements have been incorporated to give these engines even more stamina, reliability and lower maintenance requirements than their famous long-lived predecessor, the General Motors 567C engine.

Normally aspirated series

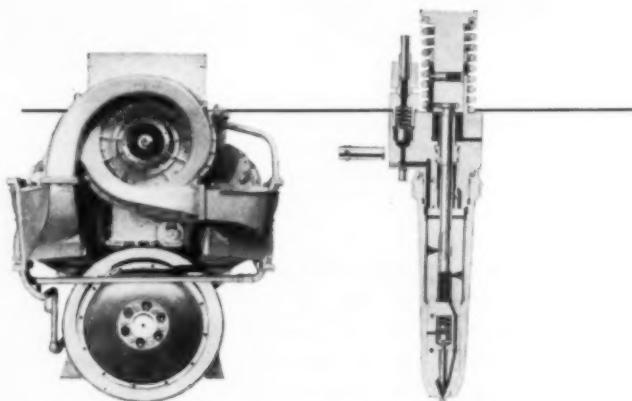
The same fundamental design is used for each engine whether normally aspirated or turbo-charged. As a result, the normally aspirated 567D-1 engine, made to turbo-charged standards, is an engine of outstanding durability and low maintenance. An increase in compression ratio from 16:1 to 20:1 and a new needle-valve injector provide for increased power and fuel economy. Specific fuel consumption at full load is 5 percent less than the previous "C" engine.

Turbo-charged series

The Electro-Motive designed turbo-charger, unlike conventional super-chargers, operates efficiently at low and high engine speeds. This feature is especially important for starting, low load and acceleration. The turbo-charged 567D-2 and 3 engines will not derate over a wide range of altitudes. Under test in actual locomotive service conditions, full engine output was maintained at over 8,000 feet altitude. In addition, the turbo-

charged engines reduce specific fuel consumption by as much as 10 percent at full load.

Continual improvement of major components has long been an Electro-Motive policy. These new engines represent more than twenty years of Diesel engine development. They are the finest expression yet of the General Motors 567 series—more powerful, more economical and even more reliable.

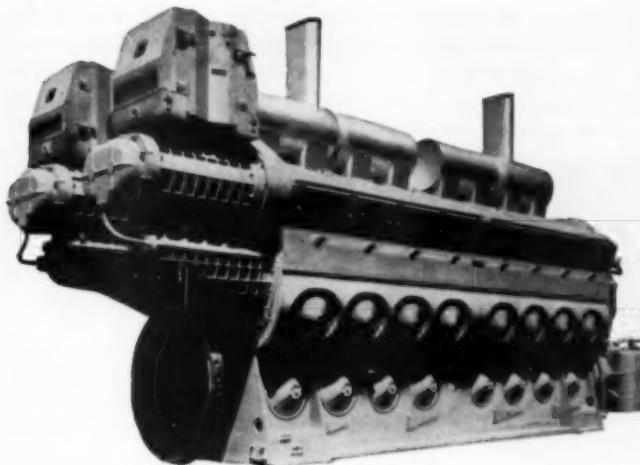


New turbo-charger is Electro-Motive designed and developed. Unit operates from engine gear train at low engine speeds, from exhaust turbine at high speeds. Combination drive provides adequate air supply at all operating levels. Turbo-charger maintains engine output in high altitude operation.

New needle-valve injector gives better fuel atomization and eliminates after dribble, both factors to improve specific fuel consumption. Electro-Motive developed, the new injector is standard on all 567D engines. It is also applicable to earlier General Motors 567 series engines and present spherical valve type injectors can be converted to the new type.

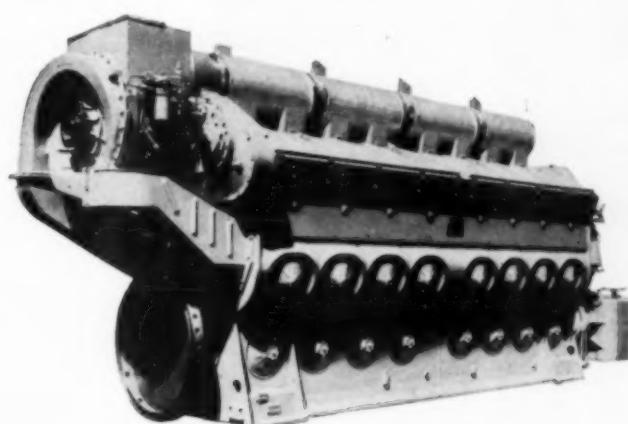
567D-1 Normally Aspirated

1800 tractive horsepower. 20:1 compression ratio. 16-cylinders. First used in the General Motors GP-18 and SD-18 locomotives. 12-cylinder version is used in the new General Motors RS-1325 locomotive.



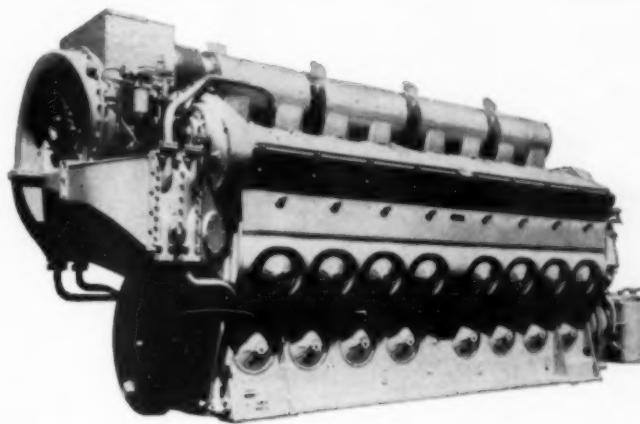
567D-2 Turbo-charged

2000 tractive horsepower. 14½:1 compression ratio. 16-cylinders. First used in the General Motors GP-20 locomotive.



567D-3 Turbo-charged

2400 tractive horsepower. 14½:1 compression ratio. 16-cylinders. First used in the General Motors SD-24 locomotive and MU-60 peaking plant.



ELECTRO-MOTIVE DIVISION • GENERAL MOTORS

La Grange, Illinois HOME OF THE DIESEL LOCOMOTIVE

In Canada: General Motors Diesel Limited, London, Ontario

Southwest Diesel

Notes

By Donald M. Taylor

OILWELLS get sick, too—and when they do a light workover rig must be called in to perform remedial work.

These units are rated by the amount of two-inch tubing they will hoist and the speed with which they can move on a job, complete it and move off. (Oil operators pay for them on an hourly basis.) Thanks to a new engine, Best Well Service, Inc. of Odessa, Tex., has increased both speed and depth range of one of its workover units. The company

replaced a 145 hp butane engine with a 320 hp NHRS Cummins diesel. The sale was made by Cummins Sales & Service, Inc. of Odessa.

T. L. JAMES and Co. of Kenner, La., has just taken delivery on a new model 595 American crane equipped as a dragline. The crane is diesel-driven; power

is provided by a 4-71 General Motors diesel engine.

DANNY BOY—has just been delivered to Antonio Chula of Bayou LaBatre, Ala., but cigars are not in order. **Danny Boy** is a fishing trawler just completed by the Covavach Shipyard. Kennedy Marine Engine Co. of Biloxi, Miss. supplied the propulsion unit:—a 6-71E GM diesel.

CRACKING the earth apart thousands of feet below the surface! That's what two 6-110 turbocharged GM diesels will probably be doing soon. They were purchased by The Western Company of Midland, Tex., for installation on high pressure pumps of the type used extensively on oilfield fracturing equipment. What do we mean by *oilwell fracturing*? Simply this. By forcing oil, water or acid back into an oilwell under extreme pressures and high volume, operators can split open the oil-producing rock (sandstone or limestone). This makes the well more productive in most instances. Usually special sand is injected along with the fluid to keep the cracks propped open.

ROLAND Construction Co. of Alexandria, La. bought a new Jaeger air compressor powered by a GM 6-71 from Southern Equipment and Tractor Company of Alexandria.

CARDINAL Chemical Co., Inc. of Odessa, Tex., replaced a gasoline engine in a B-62-SX Mack tandem truck-tractor unit. The new engine which was sold by Cummins Sales & Service, Inc. of Odessa is a JNS-6-B Cummins diesel rated at 175 hp.

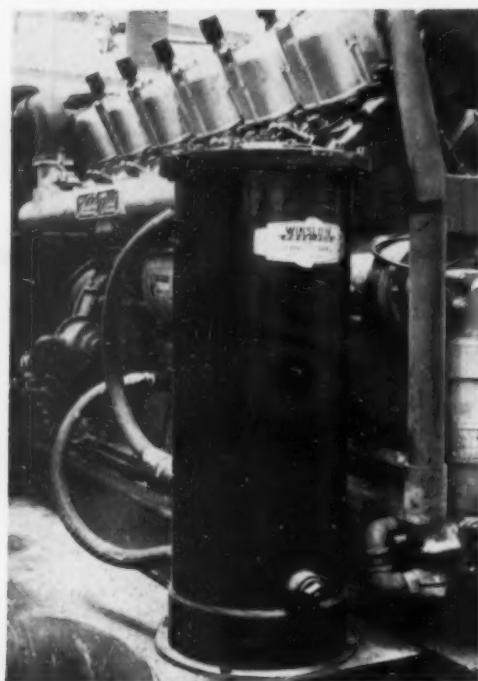
AiResearch Plans Addition

Plans for erection of a 10,000 sq. ft. receiving and storage building have been announced by The Garrett Corporation's AiResearch Industrial Division. The new receiving structure will be added on to the present production facility, next to the machining area. This location will provide a straight through flow of materials used in production of AiResearch turbochargers, turbocharger controls and specialized valves. It will bring AiResearch industrial division's total enclosed area to 60,000 square feet.

610 Generators Ordered

A contract for 610, 30 kw diesel-driven engine generator sets totalling \$1,578,558 has been awarded to Kurz and Root Company, Appleton, Wis., by the U. S. Army corps of engineers according to an announcement from E. B. Brownell, the company's president. The generator sets are for Air Force use. Delivery will begin in May, 1960 and will be completed in December of 1960.

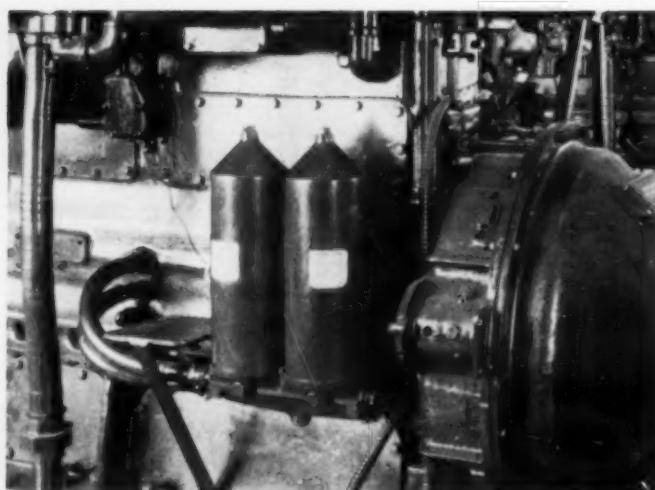
WAUKESHA's long use of WINSLOW



Winslow CP* Filters on Waukesha V-12 800 hp Diesel

TWO filters in ONE!

TWO materials—Fine and Superfine
—in each Winslow
CP* element con-
tinuously self-ad-
just pressure, give
TRUE full-flow of
filtered oil—without
incurring exces-
sive back pressures.
*Controlled Pressure.
Patented, U.S. and foreign patents.



Waukesha gas engine type 6-NRK with Winslow Filters

There's a Winslow CP* element to fit your filter—any standard type, gasoline or diesel, fuel or lube oil. Switch to Winslow for long engine life!

Write for: "The Stirring Saga of
Big Drip and Little Drip!"
and their capture by the Winslow Boys!

WINSLOW

ENGINEERING & MANUFACTURING COMPANY
4069 Hollis Street, Oakland, California, Olympic 2-0288



Inland River Reports

By A. D. Burroughs

MAXON Construction Co.'s marine division, Tell City, Ind., delivered the neat new towboat, *Edward H.*, to Federal Materials Co., Paducah, Ky. Wayne Supply Co., Louisville, provided two Caterpillar engines, model D353, rated at 290 hp each at 1200 rpm.

HOUSTON branch of White Diesel Engine Division, White Motor Co., supplied two Superior engines, model 40M5x6, installed on the 1000 hp *Ellen H.* This 64.6 x 24 ft. towboat was completed for and by Hawkins Towing and Barging Co., Inc., Beaumont, Texas.

NEW YORK, first of seven new diesel harbor tugs replacing coal-fired steam tugs for Pennsylvania Railroad, has been completed by Dravo Corp. The 105 x 26 ft. tug has 1200 hp delivered by a GM 12-567C engine.

BELL Marine Service, Houston, has put the new craft, *Commuter*, into active service. Built by Harrisburg Machine Co., Inc., Houston, the 65 x 24 ft. vessel has propulsion power supplied from a pair of Superior engines, model 40M5x8, rated at 650 hp each.

ARIES, the *Ram*, is the new switchboat for the new firm, Meteor Towing Corp., St. Louis. Delivered by St. Louis Shipbuilding and Steel Co., the 48 x 18 ft. craft is powered with two 205 hp General Motors engines.

WAUKESHA engines provide push power for the new harbor boat, *Mark-M.* The 54 x 19 ft. craft was delivered by Yates Marine Service, Wheeling, to Merdie Boggs and Sons, Inc., Catlettsburg.

TWO General Motors (Detroit) engines, model 8V-71, rated at 225 hp at 2000 rpm., will be installed on the new *Slade Brown*. The 55 x 20 ft. towboat under construction at Gulfport Shipbuilding Corp., Port Arthur, Texas, will see service for Higman Towing Co.

SOUTH America's busy Gulf of Paria gets a new supply vessel, *Pamela*, performing for owners Terminales Maracaibo, C.A., Venezuela. Completed by Products Division, Todd Shipyard, Houston, the 145 x 35 ft. vessel gets 1000 hp from a pair of Caterpillar engines.

E. F. CAMPBELL, sister-ship in design to the familiar *Tom Ragsdale*, joins the Ohio River Company's fleet at Cincinnati. Built by St. Louis Shipbuilding and Steel Co., the 90 x 28 ft. towboat has power supplied by two Caterpillar engines.

NEW twin-screw towboat, *Charleroi*, is in action for builders-owners Marine Sales and Service and Hiermaux Hardware, Charleroi, with power from the two GM Detroit 6-71-E engines.

SOUTHERN Shipbuilding Corp., Slidell, La., completed the task of joining two well-known boats, the *Carpaul* and the *Carpolis* into one new unusual

five-screw towboat, named *Carcities*. In service for Cargo Carriers, Inc., the new craft measures 195 x 44 ft.

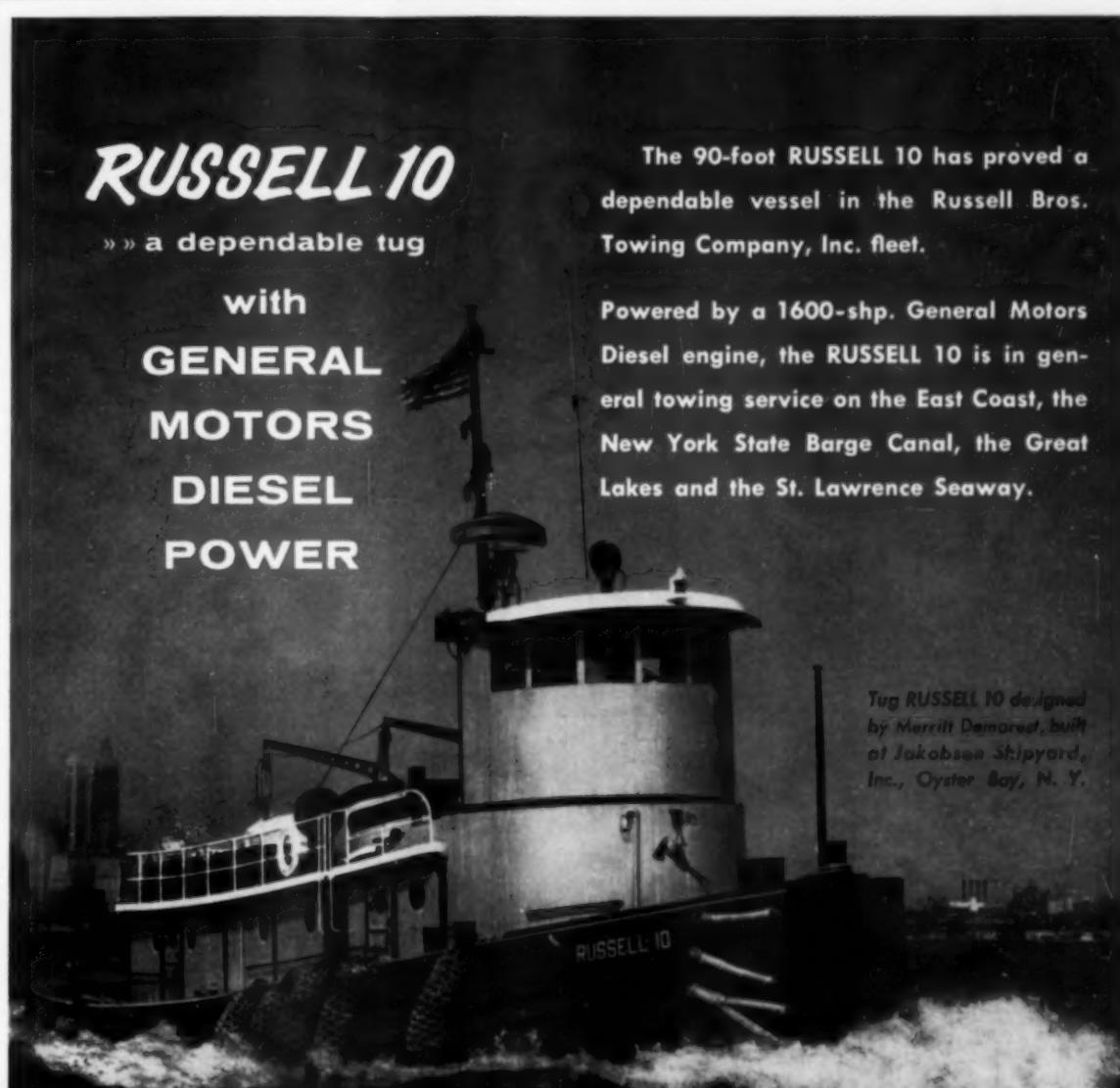
Massey-Ferguson Names Manufacturing Director

William D. Walker, formerly general manager of Ford's Oakville assembly plant near Toronto, has been appointed director of manufacturing, North Amer-

ica, for Massey-Ferguson, it was announced by T. J. Emmert, vice-president, North American operations. Mr. Walker will be responsible for the company's manufacturing operations within the United States and Canada with plant facilities employing 8,000. Massey-Ferguson produces a wide range of farm and light industrial machines and equipment.

RUSSELL 10

»» a dependable tug
with
GENERAL
MOTORS
DIESEL
POWER



The 90-foot RUSSELL 10 has proved a dependable vessel in the Russell Bros. Towing Company, Inc. fleet.

Powered by a 1600-shp. General Motors Diesel engine, the RUSSELL 10 is in general towing service on the East Coast, the New York State Barge Canal, the Great Lakes and the St. Lawrence Seaway.

Tug RUSSELL 10 designed by Merritt Demarest, built at Jakobsen Shipyard, Inc., Oyster Bay, N. Y.

Wherever dependability is required of engines, General Motors Diesels are first choice... on the rivers, in the harbors and on the high seas.

CLEVELAND DIESEL ENGINE DIVISION
GENERAL MOTORS CORPORATION
CLEVELAND, OHIO
SALES AND SERVICE OFFICES:
Chicago, Ill. New York, N. Y. St. Louis, Mo. Seattle, Wash.
New Orleans, La. Pittsburgh, Pa. San Francisco, Calif. Wilmington, Calif.

A GOOD PRODUCT PLUS GOOD SERVICE GIVES TOP PERFORMANCE

West Coast News

By James Joseph

FOR George Fay's 70 ft. yacht *Marrowene*, Vancouver, B.C., two GM model 6120T marine diesels (300 hp each at 2300 rpm), driving three-bladed 29x25 in. props thru Allison reverse reduction gear, 2:1 ratio . . . sale by Hoffars Limited, Vancouver.

TO OREGON Tire Co., a subsidiary of Butler Battery and Tire Co., Portland, Ore., an Allis-Chalmers FT-20-24 lift truck.

CONTRACTOR N. A. Artukovich, Montebello, Calif., has taken delivery of an SL-1 Lister-Blackstone 4 1/4 hp at 1800 rpm diesel to repower a construction site pump. Sale by Los Angeles Industrial Engine Service.

FOR the Royal Canadian Mounted Police 55 ft. motor vessel *Sidney*, operating from Vancouver, B.C., two GM (model 6122T and 6123T) diesel engines, swinging 29x25 in. props thru hydraulic Allison reverse reduction gear.

ATHENA Mills, Athena, Ore., has taken delivery of a Clark Torcon model C-400 converter for use in log loader operations in Oregon. Sale by Hamilton Engine Sales, Inc., Portland.

TO Potlatch Forests, Inc. Lewiston, Idaho, eight model DAS-844 Allis-Chalmers diesel engines to repower ENO8D Mack trucks.

FOR the *Wayfarer No. 1*, owned by Terry Burt, a GM marine diesel model 62206 driving 56x30 in. prop thru 4.5:1 hydraulic reduction (Allison) gear. 33 ft. vessel, a log towboat, works out of Point Grey Towing Co., Fraser River, B.C.

WATER Equipment Service Co., Victorville, Calif. has purchased an HD-277 Continental diesel (max. 68 hp at 1800 rpm) to power a deepwell irrigation pump near Calico, Calif.

FOR use aboard shrimp boat operating off Guaymas, Mexico, an American Marc AC-1 (6 hp at 1800 rpm). Sale by Aturo Morales, S. A., Guaymas.

TO repower the tow boat *Grapple*, owned by Gulf of Georgia Towing Co., a GM marine 62206 diesel driving 46 in. x 2 1/2 in. prop thru 3:1 reduction. *Grapple* recorded 10.4 knots at recent Vancouver, B. C. trials.

WORKING as a dozer boat (in log storage) is the 16 ft. *Gary*, owned by Cattermole-Trethewey Contractors Ltd., powered by a GM marine 3071C diesel

driving a 3-bladed prop (24 in. x 16 in.) thru 2:1 ratio reverse reduction gear. Boat operates British Columbia waters.

CANADIAN Fishing Co., Prince Rupert Harbor, B. C., has installed its 60 ft. fisher *Supreme No. 1* with a GM marine 6071C engine, driving a 40 in. x 25 in. prop thru 3:1 hydraulic Allison reverse reduction gear.

TRANSCON Lines, which operates a 12,000 mile nation-wide system, from Chicago and Atlanta west, announces purchase of 36 White Freightliner tractors, powered with NHB-600 Cummins engines, as part of its \$1,230,000 over-the-road equipment expansion.

FOR the 50 ft. logging vessel *Sea Son*, owned by M. R. Cliff Tugboat Co.,

Vancouver, B. C., a GM 62206 marine engine. Sale by Hoffars Limited, Vancouver.

A PORTLAND, Ore. hay baler manufacturer has taken delivery of a number of Deutz F3L-712 engines.

TO west-operating Watson Bros. Transportation Co., Inc., based in Omaha, the



...AND AMERICAN BOSCH IS

first of the newly introduced cab-forward Dodge diesel tractors, powered by a 290 hp Cummins.

FOR Cattermole-Trathewey Contractors Ltd's 16 ft. dozer boat *Roddy*, a GM 3071C marine engine, rated 68 hp at 1800 rpm, 110 hp max., driving 24 in. x 16 in. prop thru 2:1 Allison hydraulic reduction gear.

FOR the Dept. of Fisheries *Pholis*, a 40 ft. patrol boat operating west coast waters, a GM 3071C marine engine. Boat recorded 10 knots in trials at Fraser River, B. C. recently.

THE 33 ft. towboat *H & R No. 2*, owned by Terry Burt, has been installed with a GM 62206 marine engine. Tug works out of Point Grey Towing Co.

FOR the 29 ft. *Kathy R*, fishing boat owned by J. Radil, Vancouver, a GM marine model 4-58 engine driving a 27 in. x 19 in. prop thru 3:1 hydraulic Velvet Drive reverse reduction gear.

New Spark Arrestor

A compact Gill spark arrestor for gas or diesel engines using a four-inch ex-

haust stack has been perfected, reports the manufacturer. It is primarily designed for preventing exhaust-spark fires around drilling rigs, pumps and other equipment used in the oil fields. By trapping almost 100 per cent of the exhaust carbon from the engine at every throttle position, having provision for easy removal of the collected carbon, and good durability, this style 9CV40 spark arrestor exceeds all test-requirements of the U. S. Forest Service, the maker reports. The arrestors are available now, according to the manufacturer, Erickson Products Co., 1960 Carroll Avenue, San Francisco 24, Calif.

ITS NEW

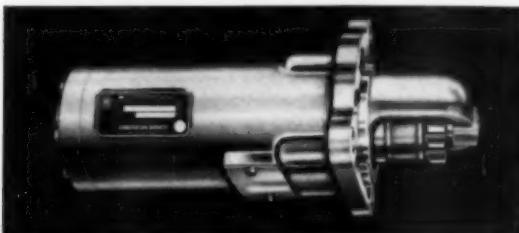
Builds Giant Salt Harvester

Said by its builder to be the world's largest, a salt harvester recently was shipped by barge from San Diego for Black Warrior Lagoon, 500 mi. south in Baja, California. The machine was built by Crofton Diesel Engine Co., San Diego distributor of GM diesel engines. The machine was designed to harvest 1,000 tons of salt an hour. The rig will be pulled by a rubber-tired, diesel-equipped tractor while the two conveyor belts are driven by an 85 hp diesel mounted on the rig. The giant harvester will feed a fleet of tractors pulling belly-dump trailers of 60 ton capacity. Running up to 40 mph, these transports haul to a marine terminal on the lagoon. Ships then transport the salt to Canadian pulp mills for use in paper making. Back of the power plant on the harvester, the Crofton firm standardized on Link-Belt apparatus—a worm-gear drive, a parallel-shaft drive, chain drives and gears, roller bearings and the rubber conveyor belts. The harvester rolls on four General tires, size 16.00-25. Elevation of the wheels and the cutting blade are controlled hydraulically by an operator. Norpak valves and cylinders are used in the control system.

Pump Model Features Single Lip Seal

The Tuthill Pump Company, Chicago, recently announced the addition of the new model LA pump to its line of over 800 models. The new model pump features a special spring loaded single lip seal developed to provide the greatest possible protection against leakage when used with all lubricating and fuel oils and most hydraulic oils. The "LA" Series is furnished in six different sizes with capacities to 6 gpm; for pressures to 500 psi; at 3600 rpm. It can be used in a wide variety of hydraulic, fuel oil, and lubricating applications. The complete Tuthill line includes a broad selection of positive displacement rotary pumps with capacities from $\frac{1}{2}$ to 200 gpm; for pressures to 1500 psi; speeds to 3600 rpm.

ITS NEW



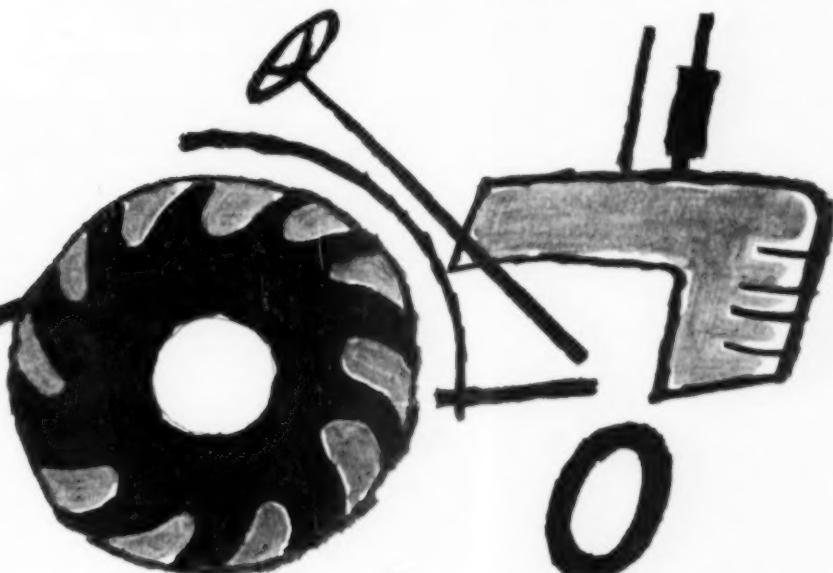
It was in the heart of the banana belt . . . at United Fruit plantations in Central America.

United Fruit banana tractor-trains—due to the humid climate—were having battery and electrical trouble. And that meant loss of efficiency, man-hours—and money.

But then American Bosch Hydrotor hydraulic cranking systems that defied the climate were brought into the picture. The Hydrotor systems, needing no storage batteries, air compressors or auxiliary starting engines—completely independent of external power source—soon solved the problem. Since that time, United Fruit has installed nearly 400 Hydrotor cranking units in its plantation equipment.

Wherever performance and dependability are paramount, American Bosch equipment will be specified . . . in fuel injection systems . . . in hydraulic systems . . . in pulse generators . . . and in a variety of industrial and consumer automotive products for all types of industry. American Bosch, Springfield, Massachusetts, a division of American Bosch Arma Corporation. Allied divisions include the Chicago Division . . . ABAMCO, Columbus, Mississippi . . . Ensign Carburetor, Fullerton, California . . . and ARMA, Garden City, New York.

AMERICAN BOSCH ARMA
CORPORATION



THE HEART OF THE PICTURE

Here's why it pays manufacturers to specify
Purolator air filters as original equipment



Materials Service Corporation of Lyons, Illinois tested Micronic® dry-type air filters for one year in its trucks and compressors. Even in the dust and dirt of contractor operations, these Purolator filters went from 6 to 8 weeks without servicing; lasted up to 3 months before replacement.

**"We proved Purolator could save us up to
\$1000 per year per truck"**

—Materials Service Corporation

Savings from reduced labor, parts cost, and maintenance downtime — plus prolonged engine life — amount to as much as \$1000 per truck each year.

That's the verdict from Materials Service Corporation, after testing Purolator dry-type air filters in its trucks and compressors for a full year. At present they are operating trucks 6 to 8 weeks between element servicings. And their Purolator dry-type air filters are used up to 3 months without replacement.

These savings are common in fleets equipped with Purolator Micronic® dry-type air filters. That's because this

Purolator filter is more than 99% effective at *all* engine speeds; its controlled porosity keeps all harmful particles from reaching the upper engine; it's easy to maintain and replace.

Remember these benefits the next time your customers specify Purolator Micronic air filters. Think about them, too, in considering Purolator air filters for original equipment on your own standard line of diesels.

Ask a Purolator Engineer to demonstrate how Purolator filtration provides advantages and economies for fleet owners — and benefits for you. Write or call today — and ask for the booklet, Purolator Micronic Dry-Type Air Filters.

Filtration
For Every Known
Fluid

PUROLATOR
PRODUCTS, INC.
RAHWAY, NEW JERSEY AND TORONTO, ONTARIO, CANADA

DIESEL FLEET BOON TO LTL TRUCKER

Red Star Express Lines' Diesel OTR Equipment Gives Fast, Efficient Customer Service; Well Planned and Executed Maintenance Program Enables Tractors To Log Up To 400,000 Miles Before Requiring Overhaul

IT took a lot of courage back in the depression depths of 1932 to expand a local delivery service into a trucking company, but that is exactly what John Bisgrove, president of Red Star Express Lines did—he bought a "fleet" of two trucks to make runs from his home town of Auburn, New York, to New York City. From this humble beginning the Red Star fleet now numbers over 600 trucks, tractors, trailers and other motorized units. Payloads this year are expected to exceed 400,000 tons consisting of approximately 700,000 individual shipments. To handle this volume Red Star operates a network of eight terminals to expedite the movement of freight between the New York Metropolitan area and upstate and western New York. A highly trained staff of 800 drivers, warehousemen, mechanics, and office workers is what makes Red Star tick.

The impressive growth of the company can be attributed to a number of significant circumstances. Industrial growth in upstate New York has been at a high level for a number of years, and the trucking industry's importance to modern economic life has been increasing at the same time. Acutely conscious of shippers' needs, John Bisgrove tailored Red Star's services to suit their particular requirements—a policy that is still the company's basic guiding philosophy. Dependable service—getting the shipment to its destination on time—is the backbone of success in the transportation industry, and to provide this every opera-

tion relating to speed and safety has been carefully analyzed by a team of transportation experts. Increased speed of delivery cannot be gained safely over-the-road, except where super highways and by-passes are constructed, so Red Star has provided the answer through improved traffic-control and dispatching techniques, streamlined materials handling methods, and a highly efficient maintenance program.

Red Star is primarily a less-than-truckload carrier, a fact which seriously complicates the movement of freight. Over 91 per cent of the total number of shipments are under 2000 lbs., and the average weight of shipments is approximately 1000 lbs. A carrier specializing in the daily handling of thousands of small, diversified shipments is required to build and maintain expansive terminal and warehouse facilities, resulting in large capital outlays. The firm's eight modern terminals serve more than 1300 shipping points and are geared to the

latest methods of moving and handling freight. All make use of palletization (moving freight on wooden pallets by means of fork trucks and of-wheeled carts). The split dock system—separating the inbound and outbound docks—is used throughout the network and greatly enhances efficiency in moving LTL shipments. Through a leased wire system, central traffic control at Auburn knows exactly the location of each motorized unit, what it is carrying, where it is going. Thus the traffic manager can utilize the fleet's fullest capacity.

Red Star's first diesels went into service in 1950 when the company purchased 90 Mack A 51 with 510 cu. in. engines. These were replaced in 1954 by Mack H63's with a 175 hp, 675 cu. in. diesel. The latest additions to the fleet were 80 Mack N61 cab forward diesel tractors also rated 175 hp purchased the end of 1958. All of these units are geared to suit road conditions encountered between upstate New York and New York City where

Two members of the Red Star fleet meet while crossing the famed George Washington Bridge over the Hudson River.



Red Star president and founder John Bisgrove (right), and Harold J. Weaver, general manager.

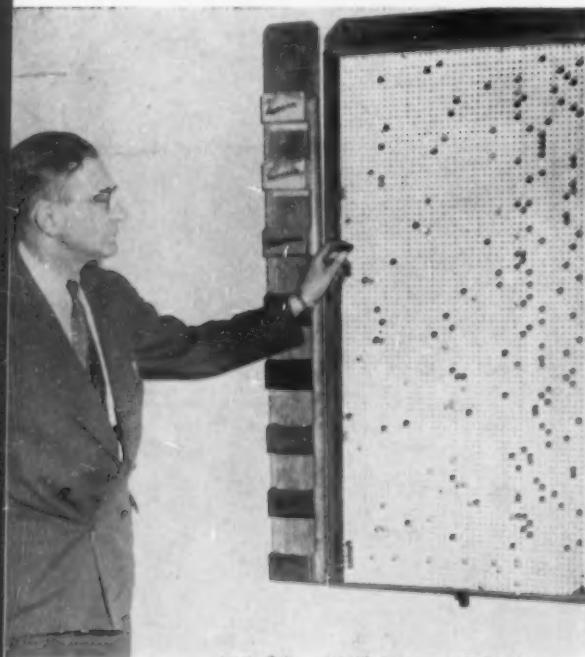


3 per cent grades are common. The units have direct drive in fifth gear to provide a cruising speed of 50 miles per hour at 2250 rpm.

A new unit at Red Star is a Mack B77 tractor powered by a 335 hp Cummins NRTOL six-cylinder turbocharged engine. Put into service this year to participate in the recent double bottom tests sponsored by the New York State Thruway Authority, this unit has been hauling 80,000 lb. loads from Syracuse to New York on the Thruway on a two round trip per week schedule.

Maintenance of both Red Star's OTR and city equipment is the responsibility of Stuart Sweet, fleet maintenance superintendent, and his assistant, Paul Brooks, who is in charge of the company's heavy maintenance shops in Auburn. A, B and C inspections on the OTR equipment are performed at 3,000, 12,000 and 24,000 miles respectively. Mileage records at the end of each trip are forwarded to Auburn where they are posted on visual control boards. Golf tees are used to represent each tractor, and they "march" across the peg

Paul Brooks, heavy maintenance shop supervisor, shows how visual control board is used for PM program. Golf tees representing the tractors move across board as mileage accumulates to flag required maintenance periods.



board at 65 miles per hole to indicate when the next inspection is due for any unit in the fleet. The A inspection at Red Star requires 1½ man-hours, the B, 8, and the C, 12 man-hours. Crankcase oil is changed when necessary, which means it is sometimes run up to 6000 miles. Crankcase oil for each vehicle is regularly checked by the oil supplier's laboratory. The analysis from the laboratory provides information regarding the amounts of foreign matter, sulphuric acid, water, fuel, and other contaminants in the oil, and further includes a recommendation regarding whether the oil should be discarded or not. These manufacturer's laboratory analyses are cross checked from time to time by analyses from an independent laboratory.

Maintenance is performed in the shops attached to the company's home office in Auburn, New York. As the mileage of each unit reaches a major inspection point on the visual control board, it is called out of service and brought into Auburn. A complete maintenance history of each unit is recorded in a special printed file folder that serves both as a permanent record and storage place for completed PM inspection forms. Red Star has found their dynamometer an extremely valuable tool in keeping their diesel equipment operating at top efficiency. New equipment is checked and tuned up shortly after receipt, and periodic inspections include check-outs and tune-ups on the dynamometer. According to Stuart Sweet, OTR maintenance is held at a high enough level so that tractors reach 350,000 to 400,000 miles before requiring an engine overhaul, and at that point the equipment is replaced. The overhauls performed in Red Star's shop are only those necessary because of failure of an engine component.

Stuart Sweet has plenty of thoughts on maintenance. People, he feels, are the most important

Ingenuity speeds servicing. Ceiling suspended hoists enable entire tractor to be lifted off floor for rapid brake and spring repairs.



DRIVER'S DAILY TRIP REPORT and PAY CARD							
DRIVE & PAY EXPLAINED HERE							
From City & State	Driver Name	Address	Phone No.	Time Leave	Time Arrive	Time Entered	Time Paid
From City & State	Driver Name	Address	Phone No.	Weight	Time In	Time Out	Pay Time
From City & State	Driver Name	Address	Phone No.	Weight	Time In	Time Out	Pay Time
DRIVE & PAY EXPLAINED HERE							
Reported by		Time Start	Time Complete	Pay Time	DRIVER'S INSPECTION REPORT		
Time Started at		Time No. on	Time No. on	Time No. on	Inspection		
TIME ALERS		DRIVER'S INSPECTION REPORT					
Leaving		<input type="checkbox"/> MOTOR	<input type="checkbox"/> TRANSMISSION	<input type="checkbox"/> REAR AXLE	<input type="checkbox"/> BRAKES	<input type="checkbox"/> LIGHTS	<input type="checkbox"/> OTHER
Arrived		Reported by					
Inspection							
Arrived		Reported by					
Comments							
Arrived		Reported by					
Comments							

Red Star's driver trip report, A, B and C maintenance schedules are standard Mack forms.

link in keeping equipment rolling. About half of the maintenance work required is the result of misuse or carelessness in handling the equipment. Careful work by maintenance mechanics who have adequate training is most important, and is the reason the company goes to considerable effort to train their personnel. Constant analysis of failures, and close cooperation with manufacturers is essential to improve equipment design and performance. Standardization is an important factor in the Red Star program. Company officials have found that using only one kind of OTR equipment helps to solve a number of problems. Parts inventories are greatly simplified and the investment in parts is considerably reduced. Not only that,

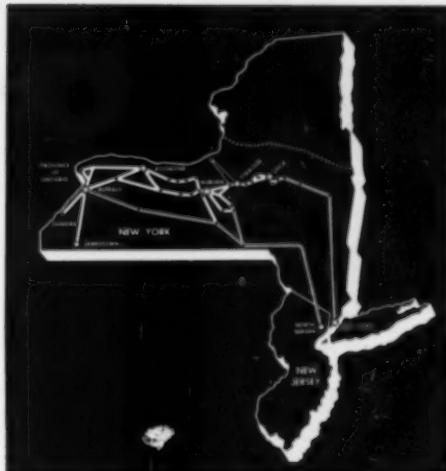


All major servicing is handled at the main shops in Auburn, New York. Here one of the Mack N61's gets a periodic check. Clayton dynamometer is used for new equipment check-ins and periodic inspections.

but when parts for only one kind of equipment are stocked, it is possible to maintain a more complete assortment of replacement parts with a reasonable capital outlay.

Another important factor in standardization is that maintenance personnel become well acquainted with the equipment. This helps considerably in analyzing problems and results in substantial time savings in maintenance and repair operations. Training new personnel is also greatly simplified, since only one type of equipment has to be mastered. Red Star maintenance personnel devote a great deal of attention to improvements that will reduce maintenance. A case in point is a bearing oil seal that enabled the use of oil instead of grease for lubricating wheel bearings. Developed at Red Star the seal eliminated the excess bearing wear that formerly occurred when cold coagulated grease failed to lubricate properly. This development virtually eliminated the company's wheel bearing failures, with an estimated annual savings amounting to \$25,000.

In the New York area it serves, Red Star is best known for two things: the general public knows the line for the immaculate trucks they see on the road, and the people they serve know them for outstanding service. Ask the man in Rochester with a small bread route who gets his daily shipment of fresh bread from New Jersey each day by 8:00 AM. Or ask the electronics manufacturer in the Auburn area who found Red Star could beat air shipments from New York City. Or if that isn't enough, ask the ice cream outlet in Syracuse about the service they get from the parent plant in New York—without refrigerated service.



John Bisgrove, President and founder of the company, is backed up and assisted by a competent staff of customer-conscious veterans in the trucking field. Among them are: Vice President of Metropolitan Operations, Leonard Bisgrove; Vice President of Sales, William J. Ritchie; Secretary-Treasurer and General Manager, Harold J. Weaver; and Assistant to the President, Lester Boyce. Red Star looks ahead to a prosperous future in the New York-New Jersey area. As President John Bisgrove put it, "The 27 years we have served this area have taught us a number of things, but the most important of them all is that our only function is to give shippers excellent service, *of the kind they want*, and that is just what we will continue to do. Diesel equipment contributes economies to help make it possible for us to offer service extras for building our business."

Red Star double bottom with Cummins NRTOL 335 hp diesel was one of the first to participate in New York State Thruway tests. Safety Supervisor, Leonard Wood, goes over last minute instruction with driver Bill Mahan.

Maintenance Supervisor Stuart Sweet points to Red Star developed oil seal that has virtually eliminated bearing failures and saved an estimated \$25,000 a year.



LSM CONVERTED FOR BEACH CARGO DELIVERY

By ED DENNIS

TWO more vessels have been added to the *Inagua* fleet operated by the West India Shipping Co., Miami, Fla. The latest additions are the *Inagua Cloud*, a roll-on roll-off 204 ft. deck cargo vessel, and the 108 ft. *Inagua Cay*, a coastal tanker currently being used in the Bahama Islands. Both are powered by a pair of Caterpillar diesel engines and both were finished at approximately the same time in the yards of Dade Drydock Co., Miami.

The West India Shipping Co., which started service in 1953, has 12 freighters and tankers in its fleet. Mr. L. Henry Read is president of the firm. Much attention is being given by the West India Shipping Co. to "over the beach" type of delivery of machinery to the various islands in South America and the West Indies. For instance in one of her first assignments, the *Inagua Cloud* was called upon to transport four 4210 hp Cooper-Bessemer engines to the Venezuelan coast. The engines, each on a low-boy trailer, were then moved off the vessel by truck to the beach. They will power a refinery being built in South America for Socony-Mobil by The M. W. Kellogg Co.

The *Inagua Cloud* is the former U.S. Navy vessel LSM 366, which saw service in the Southwest Pacific area during World War II. Any similarity to the original Navy craft that "hit" the Pacific island beaches is coincidental because the *Inagua Cloud* has been completely redesigned and reconstructed for her new role as a West Indian deck cargo vessel. The craft has a 38 ft. beam. Its draft is 9 ft. Tonnage is 650 dry weight, 196 net and 596 gross.

Heart of the reconstructed vessel is the spotless engine room under the supervision of Chief Engineer Gus Forbes. Propulsion is provided by a pair of model D397 series D Caterpillar turbocharged marine diesel engines, each rated 500 cont. hp at 1225 hp. These 12 cylinder, four cycle diesels, with a bore and stroke of $5\frac{1}{2}$ by 8 in., can develop a maximum hp of 650. The diesels drive a 5 blade, manganese bronze 58 x 43 propeller through a 2.97:1 reduction gear to give the *Cloud* a speed of 11 knots at 1200 rpm light and 10 knots loaded. The steel propeller shaft is 5 in. in diameter. In addition to the 500 hp main engines, the vessel carries two model D342 Caterpillar diesel generating sets. Each has a 100 kw, 24/480 volt, three



phase, 60 cycle, 125 kva SRCV generator. A Peter 2 cylinder, 12 bhp diesel engine drives the air compressor used for starting. The engine room, measuring approximately 55 ft. x 35 ft., is more than adequate for the machinery. Fuel oil capacity is 30,000 gal. of Belcher No. 2. The boat carries 4,779 gals. of fresh water and 250 gals. of lube oil.

Engine maintenance requirements have been negligible. The main engine hour meters read 1010 for each engine; lube oil filters were changed at 750 hrs. At 1500 hrs., Chief Forbes expects to change the lubricating oil. On the generating sets, the lube oil and filters have been changed four times in 1200 hrs. He expects to maintain this schedule. Fuel oil consumption runs about 1400 gals. per 24 hrs. for both main diesels and one generating unit. The lubricating oil consumption is about $2\frac{1}{2}$ gals. per 24 hrs. for all engines.

The *Inagua Cloud* has several unique features, including split forecastle, wheelhouse amidships and the bow ramp. The split wheelhouse permits unobstructed deck cargo space almost the full length of the vessel. The unencumbered stern allows loading "walk on" cargo of many different types. Entire truck loads or trailers can be driven on and off. The shallow draft and bow ramp are essential to enable the ship to navigate and discharge cargo along the shallow shore line and bays of the various small West Indies islands. Crew quarters, engine room and the various water, fuel and ballast tanks are below deck. The hull was constructed of $\frac{1}{4}$ in. steel plate. Double decking of $\frac{3}{8}$ in. steel plate was installed. The superstructure is almost completely new.

The twin screw *M. T. Inagua Cay* was especially designed to navigate the shallow waters off the Bahama Islands. The tanker has a beam of 24 ft. and draws 8 ft. of water. Its eight tanks are capable of carrying 49,084 gals. of oil. Four of the ship's engines are Caterpillars. The propulsion engines are two model D342 diesels. These 6 cylinder engines have a bore and stroke of $5\frac{1}{2}$ x 8 in. and develop 150 cont. hp at 1200 rpm. They are equipped with Twin Disc 2.96:1 clutch and reduc-

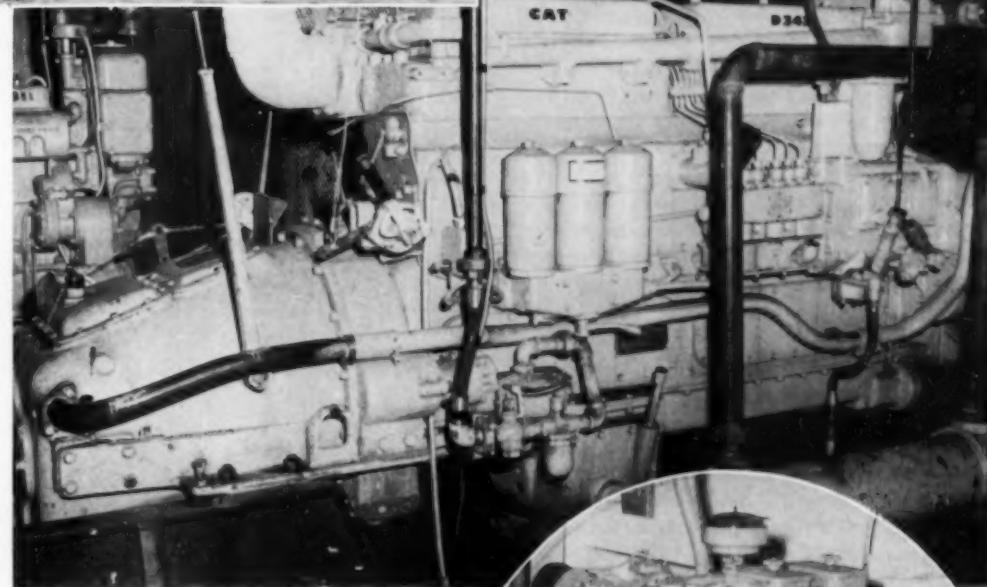


The *Inagua Cloud* at a Venezuelan refinery beach as the first of four 4210 hp Cooper-Bessemer engines is moved off the cargo deck.

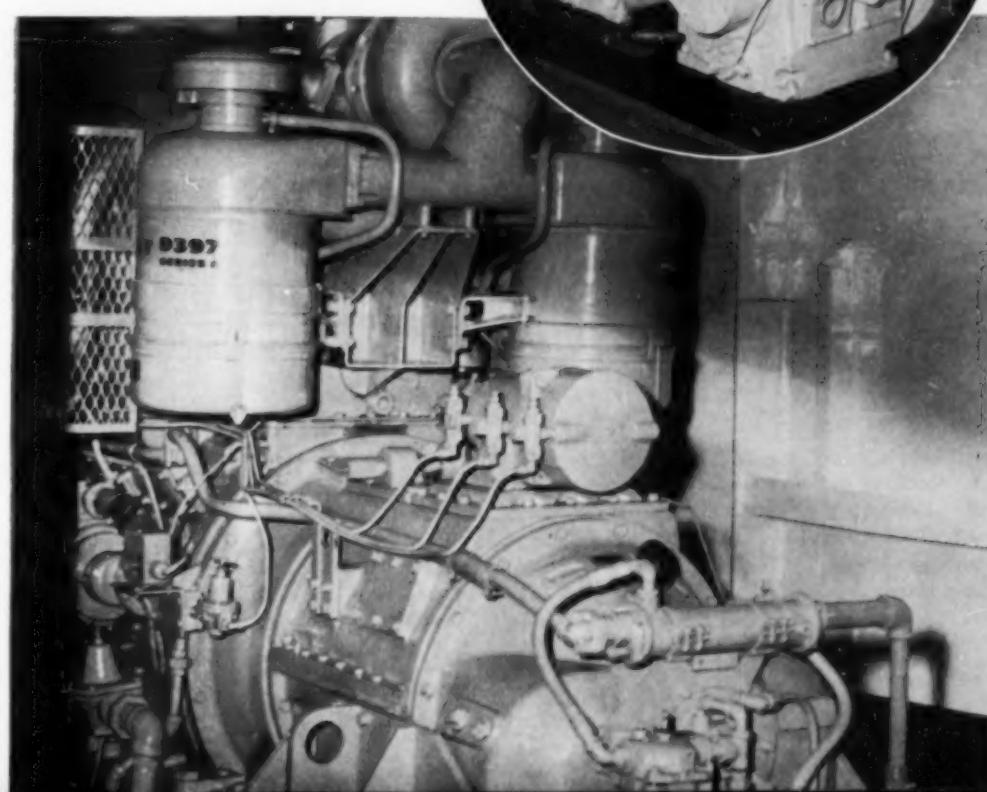
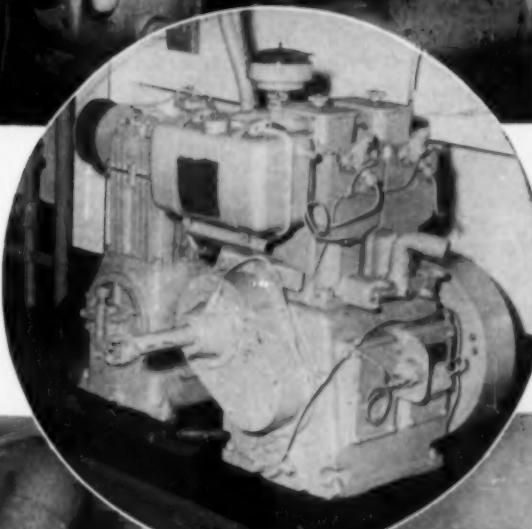


The *Inagua Cloud* a 204 ft. roll-on roll-off deck cargo vessel converted from a navy L. S. M. by Dade Drydock of Miami for West India Shipping Co. agents for the vessel. Capt. Ronald Hodgkins of Nassau is the skipper. This picture was taken on her way out to sea for her trial runs off the Florida coast.

One of the pair of model D342 Caterpillar marine diesel engines rated 150 cont. hp at 1200 rpm on the *Inagua Cay* with Twin Disc 2.96:1 r&e gears and Ross heat exchangers.



The 2 cycle 12 bhp Petter diesel engine used as power for the Quincy air compressor. This unit is used for dead starting.



tion gears which are controlled from the wheelhouse by steel cables. The two 4 1/4 in. diameter, 13 ft. long monel propeller shafts turn 50 in. diameter x 30 in. pitch manganese bronze 5-blade Ferguson screws to move the boat at 9.5 knots.

The *Cay* carries for its own use a total of 1870 gals. of No. 2 fuel oil. Its daily 24 hr. fuel oil consumption for both main engines is 346 gals. The ship's service generator sets are Caterpillars, a 65 max hp, 4 cycle, single acting diesel engine driving a 20 kw, 440 volt, 60 cycle ac generator. A Petter model AV-1, 1800 rpm, 1 cylinder diesel engine powers the air compressor used for starting.

The vessel is of the well deck type has twin rudders as well as twin screws. It has a closed forecastle. The rudders are constructed of double plates, streamlined hanging, balanced type and set on centerline of tail shafts. All seams and butts are welded. Deck plates are of $\frac{3}{8}$ in. steel with $\frac{3}{8}$ in. plate doublers in place at windlass, capstan, butts and chocks. Poop and forecastle decks are of $\frac{5}{8}$ in. plate. Shell, bottom, poop and forecastle sides are $\frac{3}{8}$ in. plate with doubles at coverboard, discharges, sea chests and under anchors.

The new tanker, like all the other vessels in the Inagua fleet, was named after the island of Inagua in the Bahamas, where the parent firm—Inagua Cloud, Ltd.—is engaged in the salt trade. As this is being written, another tanker—the 193 ft. *Inagua Tern* is crossing the Pacific from Japan to be added to the fleet. It is powered by a pair of D375 Caterpillar diesel engines. This vessel will operate out of Trinidad. Leon Dollet is port engineer of West India Shipping Co., agents for Inagua Cloud Ltd.

Principal Equipment Serving *Inagua Cloud* and *Inagua Cay*

Main engines	Caterpillar
Auxiliary engines	Caterpillar
Turbochargers	Garrett
Reduction gears	Twin Disc & Snow-Nabstdt
Silencers	Maxim
Heat exchangers	Ross
Air motors	Schwitzer
Air compressors	Quincy
Compressor engines	Petter
Lube oil filters	Cuno
Air controls	Westinghouse Air Brake
Air cleaners	Donaldson

DIESEL JOINS STEAM UNITS; PLANT MORE VERSATILE

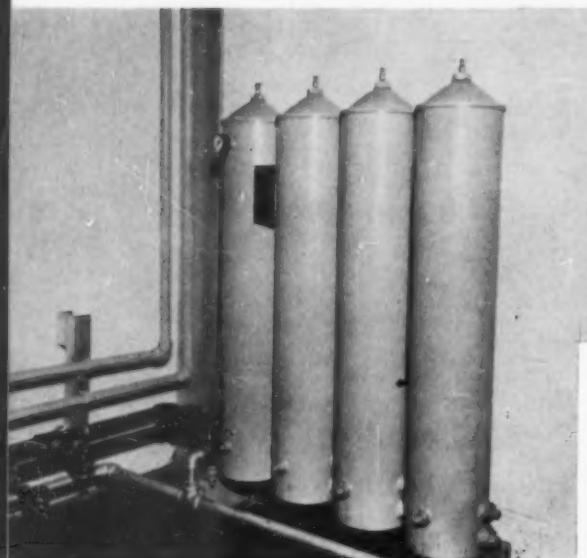
A 900 KW Fairbanks-Morse Dual Fuel Diesel Teams Up With Steam Turbines At Clay Center, Kan., To Handle Peaking, Emergency Service; Costs Cut

A 1280 hp Fairbanks-Morse opposed-piston diesel has teamed up with the steam turbines in the Clay Center (Kan.) municipal power plant to improve operating flexibility, handle peak loads and improve standby protection. Cost reduction was not the primary objective, but this too has been achieved. Clay Center is the seat of agricultural Clay County. With the farm scene changing—ever larger units continue to replace the small family farm—Clay Center civic leaders made concerted effort to attract industry and maintain a balanced, prosperous economy. Five new industries have located in Clay Center in the last two years. Some established industries have expanded.

A dependable supply of electric power at favorable rates was an important element in the success of this industrial expansion program. The municipality has operated the electric utility since 1907, when the first steam units were installed. Two steam plants adjoin it today. Two turbines in the old plant operate at 200 psig and must be considered obsolete. One is rated at 500 kw and the other

This 1280 hp Fairbanks-Morse opposed-piston dual fuel diesel with its 900 kw F-M alternator is used for peaking and emergency service.

Superintendent of Utilities Harold R. Volkmann inspects the Fairbanks-Morse dual fuel diesel. The engine has improved plant operations and cut standby costs.

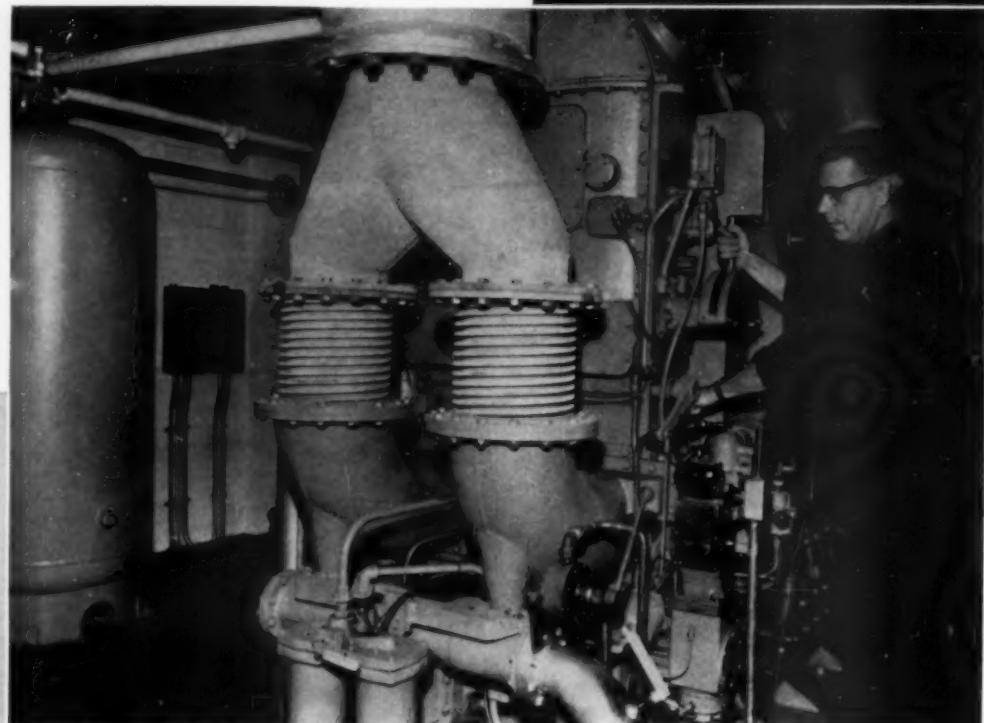
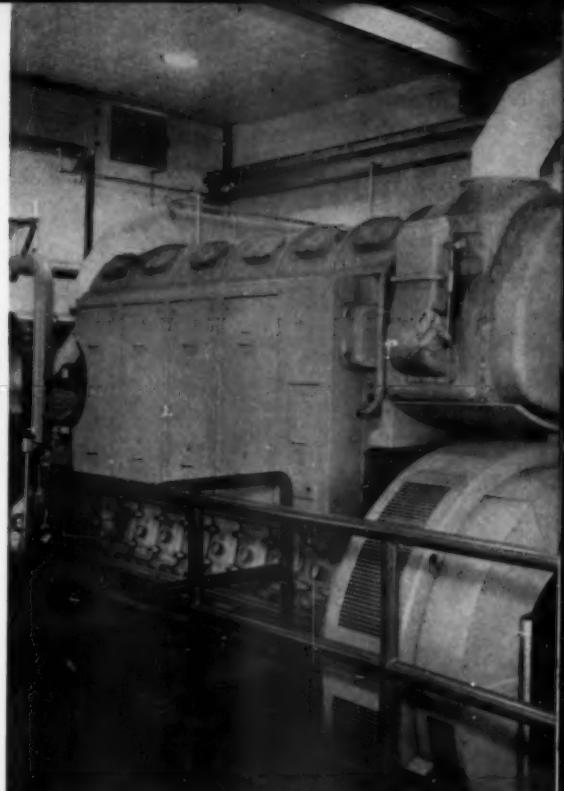


Lube oil is bypassed through this 8-element Fairbanks-Morse cartridge-type filter.

at 1000 kw. A 1500-kw unit in the plant has 400 lb. operating pressure. In the new plant across the street are a 1500 kw turbine installed in 1942 and a 3000 kw unit installed in 1949, both operating at 425 psig. All the turbines are Allis-Chalmers except the last, a General Electric. With expanding industrial load and the greater domestic

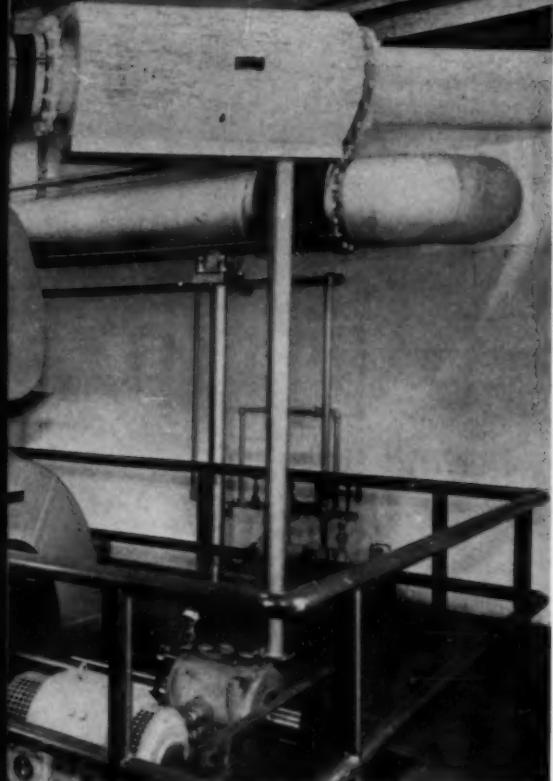
demand of a population nearing 5000, additional generating facilities were needed for efficient handling of short-term peaks and to guard against long outages in the event of boiler failure. With no interconnections, Clay Center must be wholly self-sufficient. For standby protection, the practice was to keep one of the low-pressure boilers in the old plant preheated all the time to provide power for starting a big boiler, a costly business. As for peaking, starting a 1500 kw turbine to carry a light load for three or four hours was uneconomical.

Following a study by A. C. Kirkwood & Associates, Kansas City consulting engineers, Superintendent of Utilities Harold R. Volkmann and other Clay Center officials decided that the best solution to their power needs was to install a diesel generating unit. The engine selected was a model 38DD8-1/8



Fairbanks-Morse opposed-piston dual fuel diesel, a heavy-duty unit rated at 1280 hp at 720 rpm. It drives directly a 900 kw Fairbanks-Morse alternator. The new engine was installed in a separate building adjoining the steam plant and was ready for service in May 1958. It was arranged for easy, coordinated operation. The turbine operator must walk over to start the engine; once it is started, he can control it completely from a panel in the steam plant switchboard.

First duty of the diesel is swift service in emergency. Trials show that the turbine operator can move to the next building, start up the engine, get back to his switchboard and put the diesel on the line in less than two minutes. This provides the 125 kw needed to bring up another boiler at maximum speed and at the same time supplies 775 kw



the summer of 1958, peaks ran up to 3400 kw; the 1959 summer peaks were expected to reach between 3800 or 4000 kw. At lower load levels, when the big turbine is down and one 1500 kw unit is in service, the diesel is called on to help. Normally, peaking service requires about three or four hours of diesel service, ideal for the quick-starting engine but not for a reserve turbine. Occasionally, however, the diesel has operated 14 hours at a stretch. Also, the diesel provides the plant firm capacity without calling on the obsolete low-pressure turbines. The boilers are gas-fired but can operate at somewhat restricted capacity on oil. The diesel, a dual fuel unit which normally burns natural gas with a small quantity of pilot oil, can carry its load just as well on oil alone. The city buys gas on an interruptible basis. When gas supply is sometimes curtailed or cut off during extremely cold weather, the diesel picks up part of the load to keep demand on the steam plant within a favorable range for oil operation.

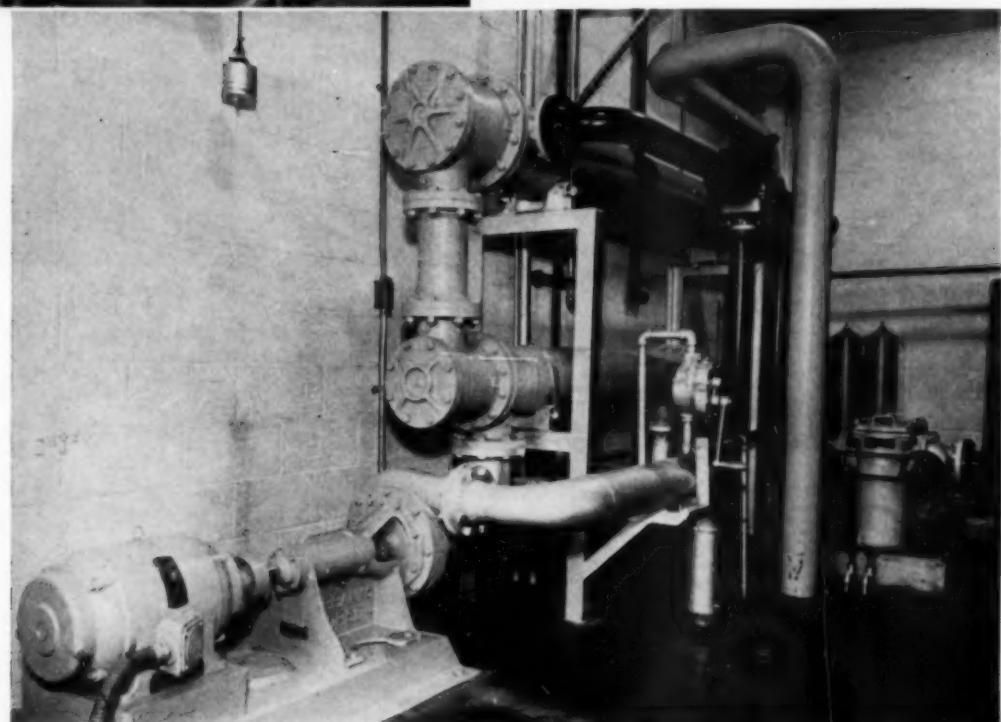
Installation of the diesel effected some immediate economies. First, keeping the standby boiler pre-

power more economically than the old low-pressure steam plant. Costs are comparable to operation of the newer high-pressure units. Acceptance tests showed that the engine performance was better than guarantees at all levels tested. On half-load dual fuel operation, gas consumption was 162 Btu high, but this was compensated by pilot oil consumption 247 Btu below the guarantee (oil costs 68 cents per million Btu and gas 22 cents per million Btu). Volkmann reported that fuel consumption in actual service had been in line with the test performance. Where possible, the diesel is operated at 650 kw or better.

To sum up the role of the diesel, F. G. Clark of A. C. Kirkwood & Associates wrote last February 2: "The diesel has improved the versatility of the entire plant. During the past year, the engine-generator has demonstrated its ability to carry part of the load during peak demands in summer, to carry part of the load during periods of gas curtailment to allow the boiler to operate on oil with more stability, and to provide immediate station power in the event of shutdown of the main turbine generating equipment." In other words, the diesel has found a home in this steam plant and has proved to be a useful member of the family.

Equipment Serving Fairbanks-Morse Diesel at Clay Center, Kan.

Engine	Fairbanks-Morse
Alternator	Fairbanks-Morse
Governor	Woodward
Switchboard panel	General Electric
Exhaust pyrometer	Alnor
Lubricating oil	Socony Mobil
Lube oil filter	Fairbanks-Morse
Lube oil strainer	Elliott
Oil cooler	Ross
Thermostatic valves	Amot
Auxiliary lube pump	DeLaval Steam Turbine
Jacket water pump	Fairbanks-Morse
Heat exchanger	Ross
Cooling tower	Pritchard
Fuel filter	Nugent
Fuel transfer pump	DeLaval Steam Turbine
Air filter	Air-Maze
Intake silencer	Burgess-Manning
Exhaust snubber	Burgess-Manning
Expansion joints	Flexonics



Accessory equipment is grouped conveniently near the diesel. Shown here are the Fairbanks-Morse jacket water pump, Ross oil cooler and jacket heat exchanger, Amot thermostatic valves and Elliott lube strainer.

for the more urgent electrical needs of the community. In an hour, another high-pressure boiler would be in service and all power restrictions lifted. Without the diesel, it would take two or three times as long to restore service.

Peaking is the job most frequently performed by the new engine. The 3000 kw turbine serves as the base load unit and the diesel is run regularly whenever load exceeds the capacity of this turbine. In



heated was no longer necessary—a saving of about \$8000 a year. The superior emergency service characteristics of the new engine also brought a reduction in insurance charges. The diesel also generates

The Fairbanks-Morse diesel is housed in this plant, which adjoins the Clay Center (Kan.) steam power plant.

CHECKER OPERATES FIRST GM 3-53 TAXICAB DIESEL

By J. W. BROWN

I JUST got back from my first ride in a taxicab powered by a GM Diesel engine, taken at the invitation of Robert E. Hunter, General sales manager of the Detroit Diesel Engine Division. The cab was sent out to my home . . . there was no one from GM Diesel along and I was given free rein to try it out and form my own impressions of its performance. Knowing my own bias in favor of diesel engines in general, I tried an experiment. Asking the driver to stop at a local business establishment, I asked the proprietor and a couple of other local businessmen who were chinning with him to come out for a short ride. There were, of course a lot of questions about what I was up to, and some wild guesses. One of the men said: "Oh, I know, we're riding in one of those rear-engine jobs and don't know it". They did comment that it was a bit noisy, but beyond that, they said only that it was fine. No smoke, no smell . . . there just wasn't any. Acceleration normal; "seems to have a lot of pep". Then I let them "in" on the secret, and had the driver lift the hood to show them the diesel engine installed there.

On the way home, I asked the driver to make a couple of acceleration tests. From a standing start,

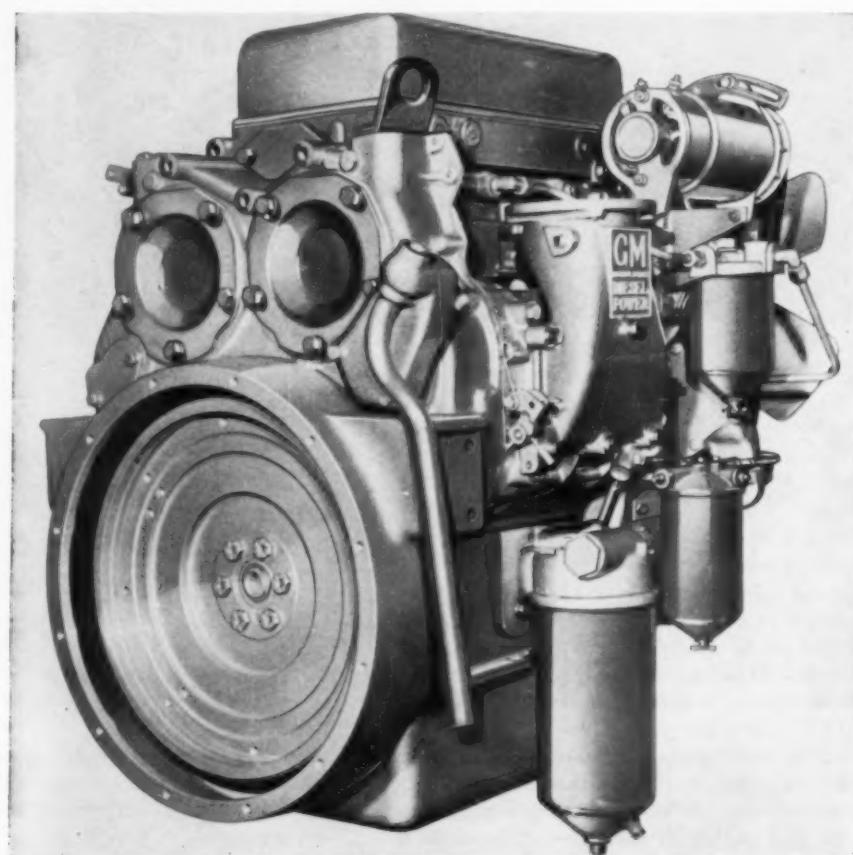
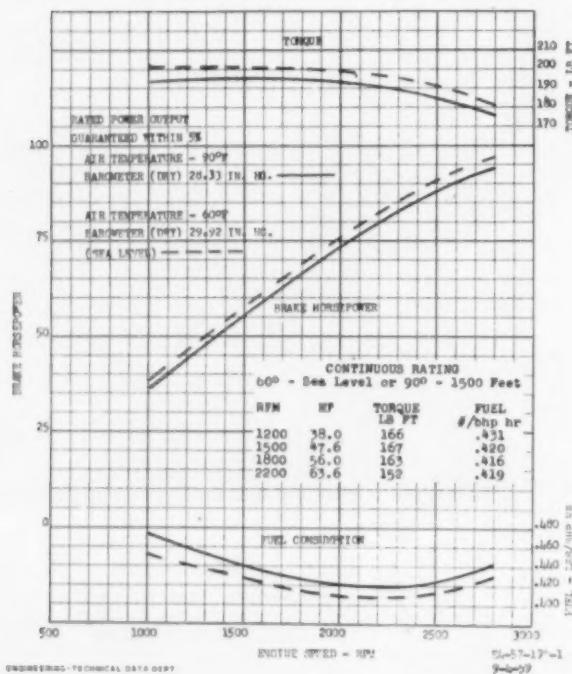
the cab accelerated to 35 miles per hour in eight seconds by my sweep-hand watch. Of course this was not an accurate test, but it seemed plenty fast to me. It should get the cab away from a traffic light about as quickly as the average automobile unless the driver was indulging in "drag race" tactics. In fact, the cab driver said that he could leave most of the traffic behind, if he desired. There is an almost inexpressible something about a good automobile engine well matched to the job; a feeling akin to having a sharp knife with which to whittle. The only way I know to describe it is by the use of the word "guts", and that is something this diesel taxicab engine seems to have in abundance.

The engine involved is an automotive GM diesel 3-53 engine; 3 cylinders of $3\frac{1}{8}$ in. bore and $4\frac{1}{2}$ in. stroke, with 97 rated bhp at 2800 rpm. It is approximately $35\frac{1}{2}$ in. high, $26\frac{5}{8}$ in. wide, $33\frac{5}{16}$ in.



The GM Diesel 3-53 engine, operating in a Checker Cab in Detroit today. This is a 3 cylinder, 2 cycle diesel with $3\frac{1}{8}$ in. bore and $4\frac{1}{2}$ in. stroke.

Power curve for basic model 3-53 diesel (four-valve head—45 cu. in. injectors.)





Posed before the brand-new National Bank of Detroit building is Checker Cab No. 3430, powered by a GM Diesel model 3-53 engine rated 97 hp at 2800 rpm.

in. long overall and fits snugly into the engine compartment of the standard Checker cab in which it has been in regular cab service for about five weeks when we first saw it. The engine had received considerable testing in the cab by GM Diesel before it was put into regular operation.

To get the owner's reaction to this installation we called Ray Eggen, who is a fleet owner in the Checker Cab Company of Detroit. Mr. Eggen said: "To understand the situation, you have to know that cab operators are in a 'squeeze' so far as profits on our operation are concerned. We can't reduce either the cost of labor or of the cabs themselves, so it looks as if our only salvation is to cut down on the cost of fuel and maintenance. So far with the GM diesel equipped taxi, we are averaging better than 19 miles to the gallon. This, with the lower cost of diesel fuel, means that we can cut our fuel costs in half, as compared to gasoline-powered cabs. We expect also to make a considerable savings in maintenance . . . in fact we think the maintenance savings with diesels will be one of the most important factors in cutting the operating costs for our fleet."

Mr. Eggen pointed out that even in the first month of operation, cabs with gasoline engines usually require carburetor and ignition tune-up,



whereas the diesel in his cab has not had to be touched yet, except for normal attention to the lube oil level. As time elapses, wear and increased fuel consumption begin to show up much sooner in the average gasoline engine than they will in diesels. "Some taxi operators have their eye on the new 'compact' cars that are being introduced, as a possible answer to our dilemma", said Mr. Eggen. "But the fact remains that they just can't be as easy to get into or out of as our present taxicabs,

and we render service to the crippled and aged as an important part of our business. Personally, I am of the opinion that only a full-sized car body, with the extra features to withstand hard wear found in any good taxicab, will serve our purpose. Such a vehicle, with a diesel engine of sufficient power should be the best answer for us."

Installation of the pilot model GM diesel 3-53 cab engine in the Checker cab in Detroit is the culmination of a plan to make this engine available to taxi operators which was announced at the introduction of GM Diesel's new 53 series engines in January, 1959. The series 53 engines, in 2, 3 and 4-cylinder inline models and in a V-type 6 are all of the open combustion chamber, unit injector, 2-cycle, blower scavenged type . . . essentially scaled down versions of the larger series 71 engines. They have made considerable progress in the industrial and marine field during the few months in which they have been available, and are now powering a wide variety of equipment including small highway trucks, fork lift trucks, portable air compressors, welders and tractors. Mr. Hunter, GM Diesel's general sales manager, believes that

Installation of the GM Diesel in a Checker Cab was accomplished with no changes in frame, or other standard components.

MULTIGRADE LUBE OILS FOR DIESELS

By BRUCE W. WADMAN

MULTIGRADE lube oils for passenger cars have been very successfully marketed for a number of years. They also show promise for a number of types of diesel and gas engine applications and have undergone extensive testing and evaluation by a number of oil companies over the past several years. Standard Oil Co. of Indiana has done some excellent work in this area, and this article primarily deals with information gained from their experience in multigrade lube oil development and subsequent application on a variety of diesel and gas engine installations.

Charts and descriptions appear throughout this article indicating specific tests on various types of equipment like buses, trucks, stationary gas engines, etc. to point out the economics of successful usage of these oils. A number of these illustrations are taken from an SAE paper given by J. M. Miller and C. C. Colyer of Standard of Indiana entitled "Multigrade Oils Pay Off In Heavy Duty Service". To get into a more detailed study of multigrade lube oils for heavy duty service let's first outline basic characteristics and physical properties this oil offers for diesel and gas engine usage. A multigraded oil SAE 10W-30, for example, has the viscosity of an SAE 10W oil during cold engine starting; at normal operating temperatures, it has the viscosity of an SAE 30 oil.

Multigrade oils have been formulated to comply with Ordnance specifications through the Mil-L-2104A Series up to and including the Supplement 1 oils. This has been very important since it has

Properties Of Typical Test Oils Used in Bus and Stationary Engine Applications

Formulation	A	B
Viscosity, SSU		
0°F	11,000	10,000
100°F	318	303
210°F	62.2	63.1
Viscosity index	137	141
Volatility, 1 mm Hg., °F.		
10% Off	327	320
50% Off	381	385
90% Off	474	505
Additive Metals, Wt. %		
P	0.19	0.15
Ba	0.51	0.80
Ca	0.03	0.03
Zn	0.11	0.12

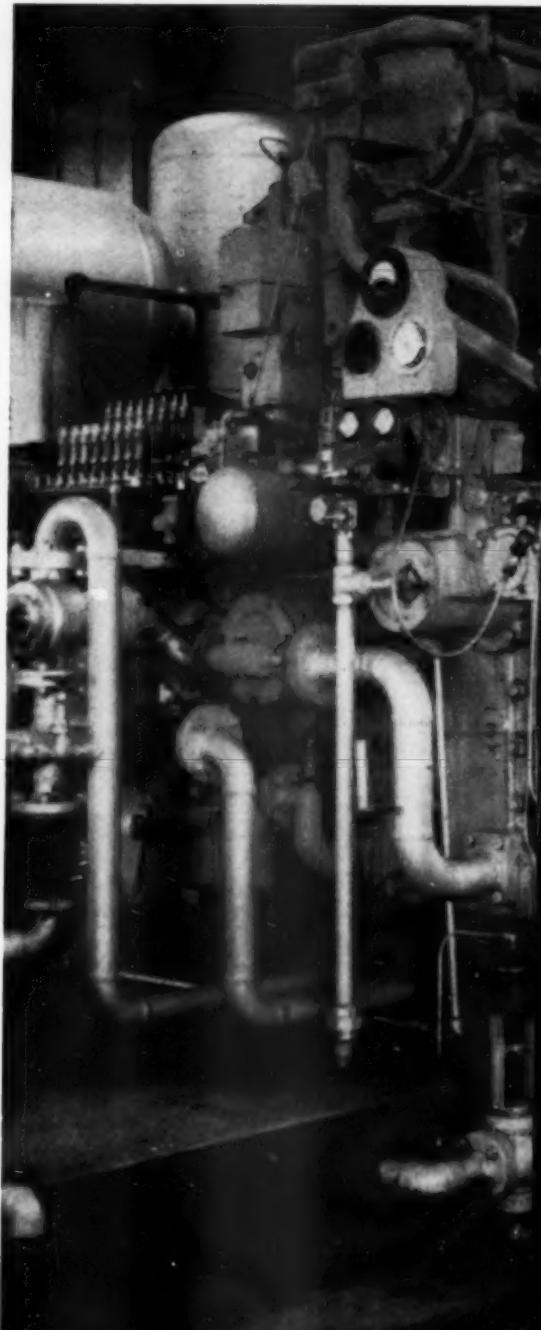
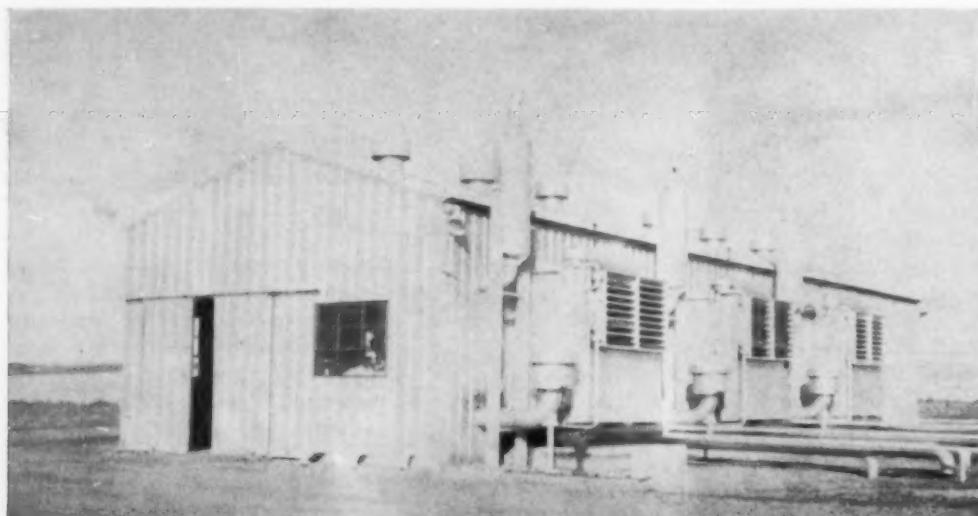
Figure 1.

not been just a simple matter of taking multigrade oils used in passenger cars and using them in rugged diesel applications. It has been necessary to formulate multigrade oils for diesels with additive treatments carefully designed to provide performance equivalent or superior to that obtained with the single grade product. This has been no easy job because a delicate additive balance in the formulation is required to achieve the high detergency necessary for the S-1 performance level. From the engine user's standpoint, it is important to know that the additives in the Supplement 1

multigrade oil enable it to control engine deposits, wear and oil oxidation as well as the corresponding single grade oil. To give top performance multigrade oils must not only meet these standards but must also have good stable viscosity characteristics required for heavy duty service. So, to gain maximum benefit and performance oil companies have taken care to formulate multigrade characteristics into good heavy duty oils.

Initially, tests were started by Standard Oil of Indiana to see if diesel engines could live at all

Unheated shed housing the Cooper-Bessemer 265 hp model GMXD-4 gas engine in the Tioga oil field area in North Dakota. This engine has compiled an impressive record in operating on Standard Oil of Indiana 10W-30 multigrade oil.



with multigrade oil. Test results produced surprising facts that make the multigrade heavy duty oil look very attractive for a number of engine applications. One very obvious advantage anticipated and achieved was better lubrication when the engine is cold and the retaining of good lubrication qualities when the engine is at operating temperatures. There had been some feeling that the longevity of multigrade oils might be limited due to loss of viscosity in service. This feature, however, has been thoroughly tested with no adverse indications. One outstanding example is the use of a 10W-30 multigrade oil in a Cooper-Bessemer 265 hp, 450 rpm, 9 1/4 in. bore, 10 1/2 in. stroke, GMXD-4 engine. This engine was housed in an unheated tin shack and was utilized for pumping gas in the Tioga oil fields. The same oil, multigrade Stanolube S-1 10W-30, has been in this engine for an excess of 13,000 hrs. without change and the used oil analysis indicates the oil to be in excellent condition. At the same location, other engines in similar service are also giving excellent performance with the oil.

In a diesel bus operation, multigrade lube oils with the properties of oils A and B shown in

Figure 1, were studied along with a single grade lube oil in eleven city buses equipped with 6 cylinder 2 cycle diesel engines. These buses accumulate 4,000 miles per month and have given over 100,000 miles of satisfactory operation on Standard Oil of Indiana multigrade lube oils. Oil drains and filter changes are made at 5,000 mile intervals. The multigrade oils gave 952 miles per gallon, compared with 696 miles per gallon with the single grade oil—an oil mileage advantage of 37% for the multigrade oils A and B. In typical stop and go operation, the buses containing these 10W-30 oils gave an average fuel mileage of 4.64 miles per gallon, compared with 4.29 miles per gallon for buses containing the single grade oil. This difference represents an 8% advantage for the multigrade oils. In this service the multigrade oils A and B saved the operator \$150 per year for each bus. Because these vehicles were housed in heated garages, no additional advantage could be claimed for low-temperature starting. However, the 37% improvement in oil mileage all but nullified the premium price for multigrade oils; the cost penalty amounted to only \$15 per bus. Thus, the net yearly saving offered by multigrade oils in the test was \$135 per unit.

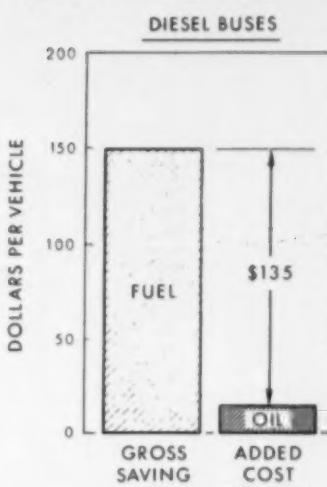
On farm equipment, multigrade oils were tested by farm tractor-engine manufacturers in controlled dynamometer tests. Oil mileage and wear were excellent in using a Standard Oil of Indiana multigrade lube oil of the S-1 detergent level. Ring sticking was eliminated in a four cycle diesel of 344 cu. in. displacement, operated 1891 hours at wide open throttle and full load. With conventional oils, ring sticking occurred before 1,000 hours and terminated the test. Another four-cycle diesel engine of 504 cu. in. displacement operated 2900 hours, which was far longer than with a single grade lubricating oil.

Carrying this further, the following have been shown to be important benefits from the usage of multigrade oils:

1. Easier starting in cold weather, particularly if equipment parked outside.
2. Low lube oil consumption—an interesting result in that it was originally thought that higher lube oil consumption might be experienced. One possible explanation of this phenomenon is that at cold temperatures a regular SAE 30 oil is quite thick and the engine cylinder parts tend to pump this oil out past the piston rings whereas the multigrade oil offering the light viscosity feature when cold allows the piston rings to function normally.
3. Better fuel mileage or lower fuel consumption—this is due strictly to frictional gains. Accompanying charts show test results in this area, which are significant in terms of possible savings particularly for large fleet operators.
4. Easing the oil inventory problem—with multigrade oils maximum flexibility of usage is assured as there is no need to have different grade oils in stock for seasonal oil changes.

Cooper-Bessemer GMXD-4 gas engine in Tioga oil fields being serviced by Standard Oil of Indiana representative T. A. Atkin. Standard oil Stanolube S-1 10W-30 multigrade lube oil has logged in excess of 13,000 hours in this engine without change and used oil analysis indicates the oil to be in excellent condition.

YEARLY SAVING WITH MULTIGRADE OIL



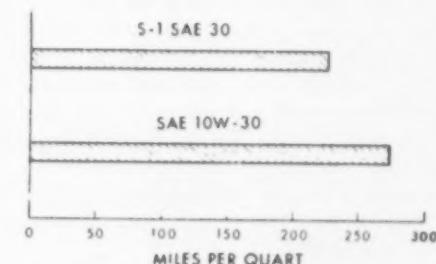
Yearly savings per unit in diesel bus use of multigrade lube oil as established in Standard Oil of Indiana field tests.

The cold weather advantages of multigrade oils form one of the most important areas of operating savings and major usage of these oils in the near future will probably be in areas of the country that have cold winters or extreme temperature variations. Some specific types of diesel and gas engine operations that look particularly good are:

1. Transit buses—particularly where buses are stored outside.
2. Over the road trucking—for cold weather starting and also where there is a lot of stop and go service.
3. Farm equipment powered with diesels where cold weather and variable temperatures are a problem.
4. Industrial engines in cold weather areas like the gas fields of Wyoming and the Dakotas where gas gathering engines must be started and operated in winter after being down for several days.

Multigrade lube oils are more expensive than regular grade oils, but the promising results indicated so far, point to operating economies far outstripping the increase in initial oil cost. Multigrade lube oils are certainly something that should be analyzed closely by engine users seeking more profitable operations. They may be just what the doctor ordered.

This chart shows the improvement in lube oil consumption achieved with a multigrade oil compared to a regular grade oil in a test on diesel trucks in severe over-the-road service at altitudes ranging from 2,000 ft. to 10,000 ft. and under temperature conditions ranging from -10°F to 90°F.





NEW TOLEDO, OHIO, \$9,500,000 SEWAGE PLANT

By JAMES W. BROWN

IN Saturday, September 19, 1959, the City of Toledo held a dedication ceremony for its new and modern sewage treatment plant in the Bayview Park area on the banks of the Maumee River. In operation since March, this efficient plant now gives secondary treatment to an average of 50,000,000 gals. of domestic and industrial sewage daily from the cities of Toledo and Maumee, the villages of Rossford and Ottawa Hills, and from parts of three adjacent townships. It has sufficient capacity to remove 90 per cent of the B.O.D. (Biochemical Oxygen Demand) for a flow of 70,000,000 gals./day. On a "primary treatment" basis (removing approximately 30 per cent of B.O.D.) the new Toledo plant can handle up to 135,000,000 gals. daily.

This is the third step in a progressive program conducted by the city since 1922. It was taken under the direction of the Commissioner of Sewage Disposal, Arthur H. Niles. The dedication was a big day in the life of Niles, who has served as Toledo's Commissioner of Sewage Disposal for nearly 28 years. It represented a job well done by Consoer, Townsend and Associates of Chicago, consulting engineers on the project. It was also a memorable day for the Enterprise Engine and Machinery personnel present at the ceremony because of the large part played in the new plant by five series G Enterprise tri-fuel engines. It was a day which should bring considerable satisfaction to Lake Erie fishermen and residents of the Maumee Bay area in that the new plant results in an 85 per cent reduction of pollution possibilities, as compared to the raw sewage which was collected at Bayview Park and pumped into the Maumee river back in 1922.

The pumping station installed in 1922 was the first step taken toward sewage disposal at Toledo. Then in 1932 a primary purification system was installed which enabled the removal of approximately 30-35 per cent of the pollutant material from the collected wastes. The new plant, on which construction was started in 1957, is an extension and refinement of method as compared to the primary treatment facilities. In case of unusual flood waters, the system provides for bypassing the secondary treatment with whatever volume is necessary to take care of the situation.

At Toledo the "activated sludge" method, with certain refinements, is used to render the effluent relatively harmless. Through this method the natural action of the bacteria present in raw sewage is speeded up by the addition of oxygen (from compressed air) and by heating in the digesters. Chemicals play a relatively insignificant part, although chlorine is used—in warm weather, especially. Liquid wastes enter the plant through the sanitary sewage collecting system and by means of pumps is lifted 30 ft. so that the flow through the treatment plant is by gravity. Coarse screening removes debris such as leaves, paper towels, etc., and short time settling follows for grit removal, with sand, stones and seeds dropping out.

In the pre-aeration unit compressed air is pumped into the flowing sewage, and a separation of greases occurs which is removed by skimming. Settleable solids are pumped to the digesters. This unit was completed in 1956. Primary settling follows, with more grease skimming and solids-settling in the tank. The settled sludge from this operation is also pumped to the digesters. The contin-



uous flow of sewage proceeds to the aeration plant by means of a long connecting channel. As the sewage enters the aeration plant it is mixed with the activated sludge that has been developed as a result of plant operation. The organisms contained in the activated sludge destroy and stabilize the organic materials present when proper conditions occur. These conditions come about in the mixed liquor tanks when sufficient compressed air is supplied over an adequate time period.

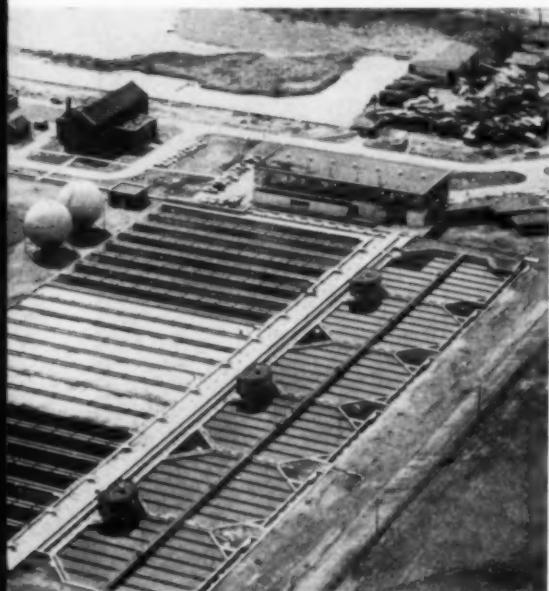
In the final settling tanks the mixed, treated sewage and activated sludge is retained long enough to allow the activated sludge to settle and a part to be pumped back through the aeration process. The overflow from these tanks constitutes final effluent, with no further treatment other than warm weather chlorination. Miscellaneous sludges which have been collected by settling processes are pumped to the digestion tanks where by biological breakdown they are stabilized and made inoffensive. Indeed, the bottom sludges from these tanks are dried for use as a soil conditioner. Another by-product, gas, is collected for plant use in the engines and for heat, saving \$50,000 yearly.

Five Enterprise series G engines were installed in the new secondary treatment plant. Except for

one, which is used to drive a 350 kw, 480-volt General Electric standby generator, they are each connected to a huge Roots-Connersville blower. All together, they can provide 70,000 cfm of air at four-pound and eight-pound pressures. Three of the blower-drive engines will be used in normal operation, with a fourth as "standby". The fifth engine provides standby electric power for fuel and oil pumps, jacket-water pumps, sludge pumps, sewage gas compressors, plant lighting, etc. A fifth

"High, wide and handsome" fittingly describes the new engine building, part of the Toledo, Ohio secondary sewage treatment plant on the banks of the Maumee River.

Aerial view of the Toledo sewage treatment plant. New engine building and secondary (aeration) tanks to right—pump house, laboratory, primary settling tanks and eight digesters to left.



ENTERPRISE ENGINES AT NEW TOLEDO, OHIO, SEWAGE TREATMENT PLANT					
Engine No.	1.	2.	3.	4.	5.
Model	TDGSG-8	TDGSG-6	TDGSG-36 Turbocharged	TDGSG-36 Turbocharged	TDGSG-36 Turbocharged
No. Cyl.	8	6	8	8	6
Bore and Stroke	12" x 15"				
Rated bhp	425 @ 327 rpm	438 @ 400 rpm	850 @ 327 rpm	850 @ 327 rpm	506 @ 400 rpm
How used:	To drive a Roots-Connersville blower, Type RODH 36 X 39 $\frac{1}{2}$ 20,000 cfm @ 4 psi.	To drive a Roots-Connersville blower, Type RODH 28 X 26 $\frac{1}{2}$ 10,000 cfm @ 8 psi.	To drive a Roots-Connersville blower, Type RODH 36 X 39 $\frac{1}{2}$ 20,000 cfm @ 8 psi.	To drive a Roots-Connersville blower, Type RODH 36 X 39 $\frac{1}{2}$ 20,000 cfm @ 8 psi.	To drive General Electric standby generator, 350 kw, 480 volt, 400 rpm, 3 phase, 60 cycle at 80% pf.

Roots-Connersville blower, rated 10,000 cfm at 8 psi is connected to a 400 rpm Electric Machinery motor as a further precaution, in case more than one engine should have to be shut down at one time. Thus the plant is made practically invulnerable, with both diesel and electric standby blower power, and with a standby diesel-electric generator set for use in case of temporary power failure.

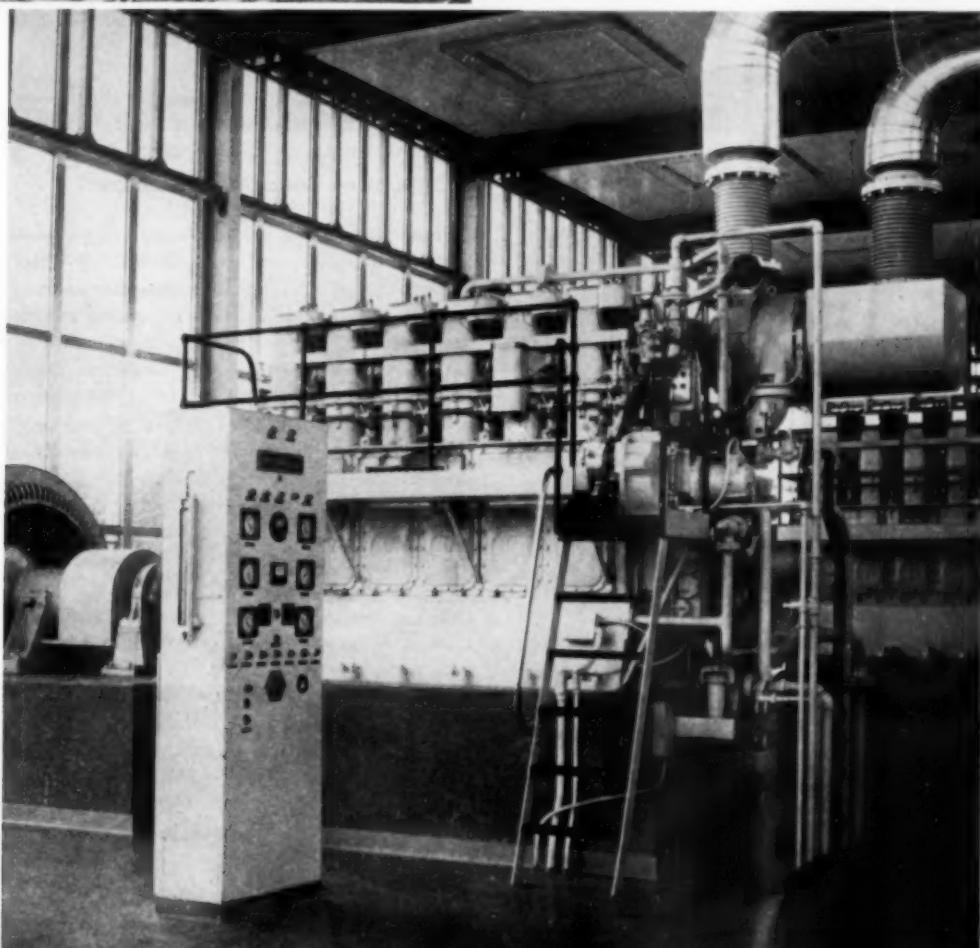
The engines are housed in a spacious, modern plant of about 75 per cent glass wall construction. Exterior brick, where used, is of variegated yellow and yellow-green glazed type. The engines are raised above the floor on attractive terrazzo covered concrete bases beneath which piers extend down through the lower floor to separate pile clusters. All motor-driven accessories are arranged on the lower floor. Here also are the huge air pipes which blend into two long, four-pound and eight-pound pressure manifolds in a gallery leading between the aeration tanks and the final tanks.

The Enterprise Series G engines provided for this job are all tri-fuel engines. They can be run as

straight diesel engines; as gas engines with a pilot injection of diesel fuel, or as straight gas engines. The switch from straight diesel fuel to pilot-injection gas operation is instantaneously accomplished by means of a lever mounted on the front of the engines. To switch to spark-ignition gas operation requires replacing the injectors with spark plugs. Individual spark coils are mounted on each cylinder head to facilitate the change-over. Three of the five Enterprise engines—two "8s" and a "6"—are equipped with Elliott turbochargers. The 8-cylinder turbochargers involve the use of an intercooler in each instance.

Each of the engines is provided with an individual gage and control panel with start and stop buttons; lube, fuel oil, fuel gas, starting air, jacket water and intake manifold pressure gages; warning lights and a signal horn for low oil pressure, low jacket water pressure, high lube oil or jacket water temperature and overspeed. The gage board also provides a pyrometer, a tachometer, and lube oil pump control buttons. The gage boards are assembled for Enterprise by a Los Angeles company. Two motor-driven compressors store air in two tanks on the lower floor level at 250 lbs. psig for engine starting. The air tanks and compressors are piped in such manner as to be interchangeable in case of the failure of one. Two electrically driven intercooler water pumps are also located below the engine room. The lube oil is cleaned for re-use in a centrifuge located in the pump building and originally used to service the lube oil of two gas engines formerly located there. One of these engines, a 4-cylinder Rathbun-Jones sewage gas engine installed in 1936 is still in operation as power for one of the main sewage pumps. This engine is said to be one of the first two built to operate on straight sewage gas by Rathbun-Jones.

Air for the engine intakes and blowers is sucked into the building through two openings about four feet wide by eight feet high. A screen eliminates leaves, insects, and debris. Passing through the screen, the air passes through fiberglass filters to collect the coarser dust particles. The air is then

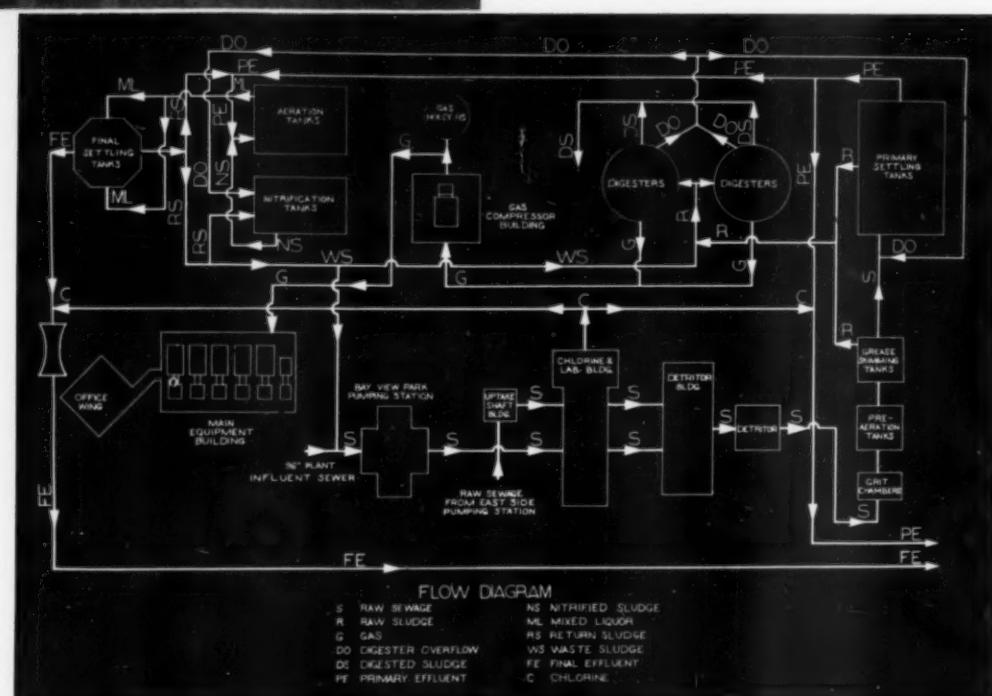


Closeup of one of the Enterprise turbocharged, tri-fuel engines and engine control panel at the Toledo installation. This 6-cylinder, 506 bhp at 400 rpm engine drives the standby General Electric generator. Note Elliott turbocharger, Woodward governor, American Bosch ignition equipment.



"VIPs" at the dedication of Toledo's new \$9,500,000 sewage treatment plant addition (L to R): C. Moeller, S. Atsatt, A. Fleischer and M. Conner of Enterprise Engine and Machinery Company; W. F. McKinney and J. W. Townsend of Consoer, Townsend and Associates; A. H. Niles, Commissioner of Sewage Disposal; A. Ostrander, Sales Manager at Enterprise; E. Pollex, Sewage Plant Superintendent; E. Davel and R. Moorehouse of Consoer, Townsend and Associates, Consulting Engineers.

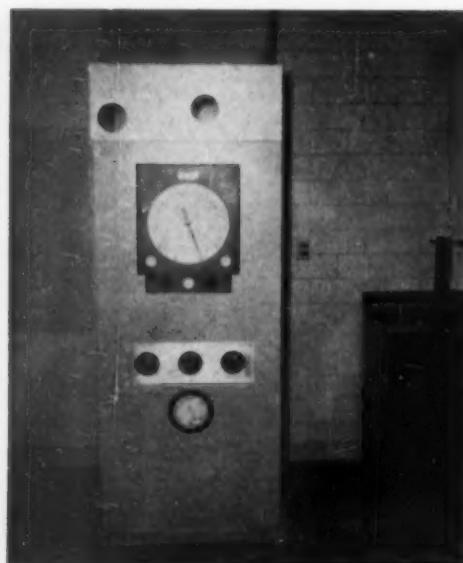
Flow Diagram.



passed through a fine oil spray bath which collects the finer particles of dust and finally passed over electro-static precipitators which attract even the finest of dust particles which may still remain. This precaution, the filtering and cleaning of the air, is expected to add years of wear and trouble-free operation to the blowers and engines since virtually no dust can get in to cause abrasive wear. Air supply for the turbocharged engines also passes through an evaporative type pre-cooler preceding engine turbocharger intake.

An extensive system of waste heat recovery is used in this installation, to provide heat for buildings and to heat the sludge in the eight digesters. The heat provided by both the jacket water and exhaust system is recovered, with the exhaust silencers and heat recovery apparatus tucked away neatly on a balcony running lengthways of the engine room. Thermometers provide readings of the heating values obtained at this point; we noted one on the exhaust system which read 170° F.

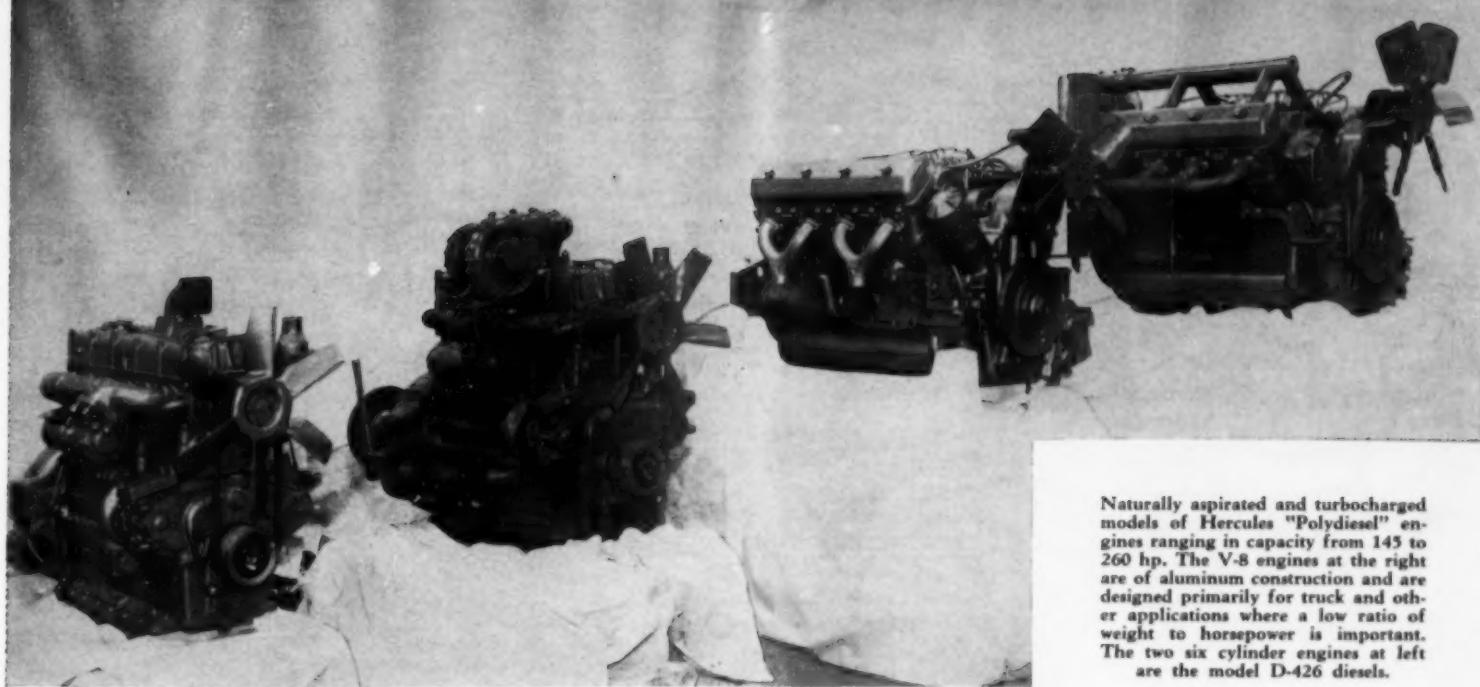
The Connelly Caloroptic gauge which automatically adjusts the proportion of sewage gas to natural gas needed to obtain desired BTU content in the engine fuel.



To the writer a new apparatus used here to automatically proportion the sewage gas and natural gas used as engine fuel seemed most interesting. The sewage gas, collected from the digesters and stored under pressure in two large spherical tanks, is not now of sufficient quantity to operate the plant alone. It is also of low BTU content (approximately 600 BTU heat value) so it must be blended with natural gas from the mains in a ratio of approximately 70 per cent sewage gas to 30 per cent natural gas for complete and most efficient operation. This is done automatically by a new type of instrument developed by Connelly, Inc. of Chicago, and Enterprise engineers. The apparatus is called the Connelly Caloroptic BTU indicator. Sewage gas is vented through a burner and lighted. The flame is "read" by an "electric eye" which actuates the blending apparatus. By opening a small door in the housing, the engineer can set the BTU content of the fuel that is wanted and the apparatus automatically adjusts the proportion of sewage gas to natural gas used by the engines to that value.

List of Principal Equipment

Tri-fuel engines	Enterprise
Turbochargers	Elliott
Blowers	Roots-Conversville
Standby generator	General Electric
Fuel injection systems	Bendix-Scintilla
Gas ignition systems	American Bosch
Governors	Woodward
Intercoolers	Young
Pyrometers	Alnor
Thermostatic controls	Amot
Waste heat recovery silencers	Maxim
Blower silencers	Burgess Manning
Air filters, precipitators & evaporative pre-coolers	American Air Filter
Lube oil centrifuge	Sharples
Lube oil filters	Briggs and Air Maze
Lube oil	Pure
Fuel oil filters	Winslow
Fuel oil	Standard
Automatic gas regulator	Connelly
Piston rings	Koppers



Naturally aspirated and turbocharged models of Hercules "Polydiesel" engines ranging in capacity from 145 to 260 hp. The V-8 engines at the right are of aluminum construction and are designed primarily for truck and other applications where a low ratio of weight to horsepower is important. The two six cylinder engines at left are the model D-426 diesels.

SMALL AUTOMOTIVE DIESELS FEATURED IN NEW HERCULES 50 TO 350 HP LINE

By BRUCE W. WADMAN

CANTON, Ohio, Sept. 30—Today I saw an exhibit and demonstration of a wide new range of diesels at the Hercules Motor Corporation plant here in Canton and was very impressed by what was shown to me. Hercules has definitely come up with some interesting new engine developments aimed at markets that have excellent potential for the volume use of diesels. The new engines include a full range of lightweight, high output automotive type diesels for light and medium duty trucks, taxicabs and small industrial equipment like fork lift trucks and other material handling equipment. Also shown was a new extra lightweight all aluminum vee type automotive diesel featuring an impressive horsepower to weight ratio of 5:1. Then to top off the show a new engine line called "polydiesel" was shown and demonstrated and proved to be a remarkable multi-fuel engine as well as a good straight diesel from the fuel consumption standpoint. The "polydiesel" features a new combustion chamber in the cylinder head that adapts it well to multi-fuel operation as well as straight diesel. All in all, the new engine line, which is all of four cycle design, ranges in size from 50 to 350 hp in three, four, six and eight cylinder models. The engines range in displacement from 169 to 779 cu. in. All of these development areas will be covered in a more detailed discussion and we will first move into the lightweight automotive diesels for the medium and light trucks and taxicabs.

Small Automotive Diesels

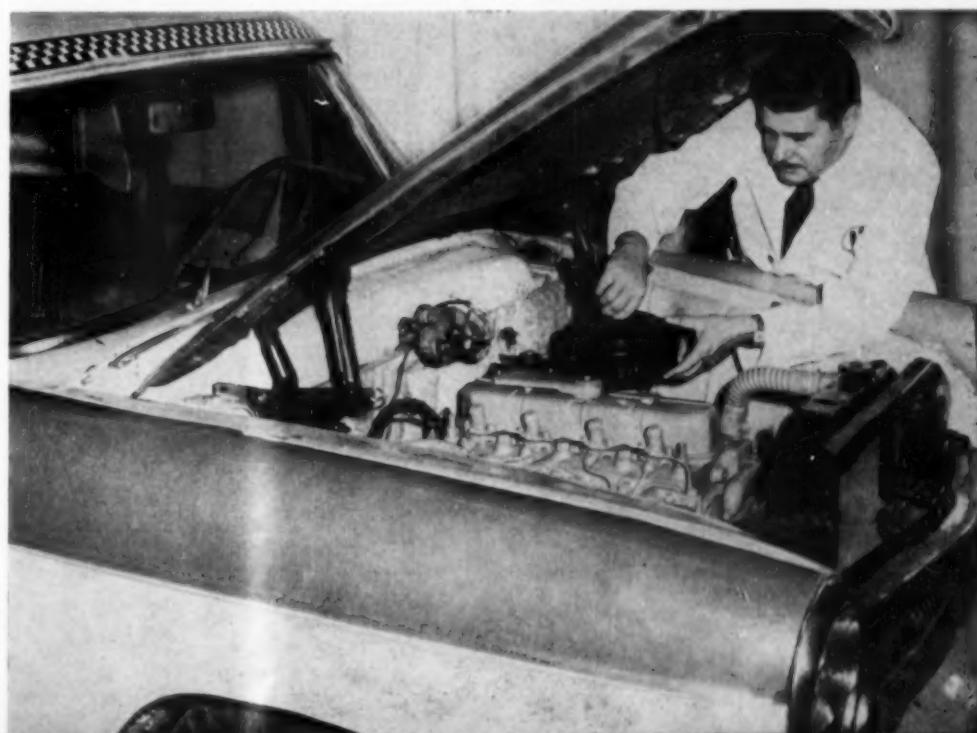
These diesels range in output from 50 to 180 hp and will handle trucks from 3,000 GVW up to 55,000 GCW. William L. Pringle, president of Hercules, commented on these engines as follows,

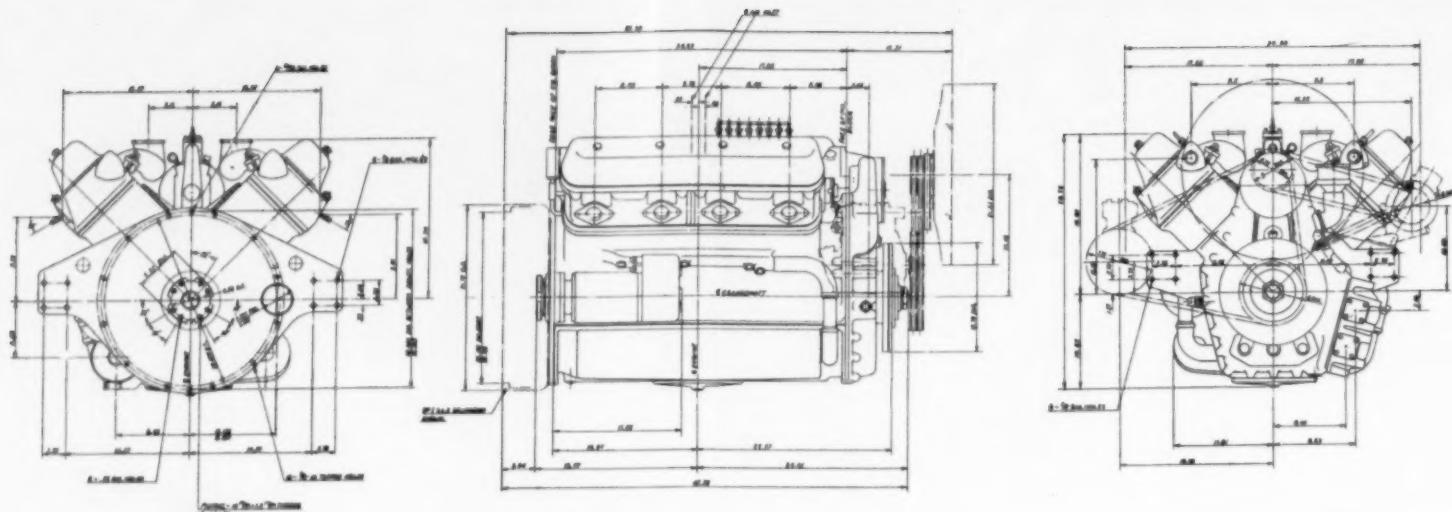
"The major significance of these new engines is that they make it economically feasible for owners of light and medium duty trucks to repower their fleets with diesels. The engines are light in weight, short in length and carry a low price tag. As replacements for the many gasoline engines in the light and medium truck class ready for overhaul or replacement, this new line of diesels is expected to create an entirely new market for Hercules. The engines are designed to permit fast, easy conversion from gasoline to diesel operation in almost any light or medium truck. Because of their high speed operation little or no changes other than replacement of the engine itself will be required in a conversion." Mr. Pringle continued, "Our new engines have been designed to solve the

problems of proper combination of weight, configuration, high speed operating characteristics and initial cost in order to make the diesel economically attractive to the light and medium truck fleet operator. Accordingly, we have high hopes that diesels in light and medium trucks will have the same degree of acceptance as they do today in large over-the-highway trucks."

In a merchandising move Hercules has announced it will publish prices for these new automotive diesels. As an example, the list price of a 115

Air filter is inspected during routine check of 4-cylinder Hercules diesel undergoing extensive road testing in a Checker taxicab.





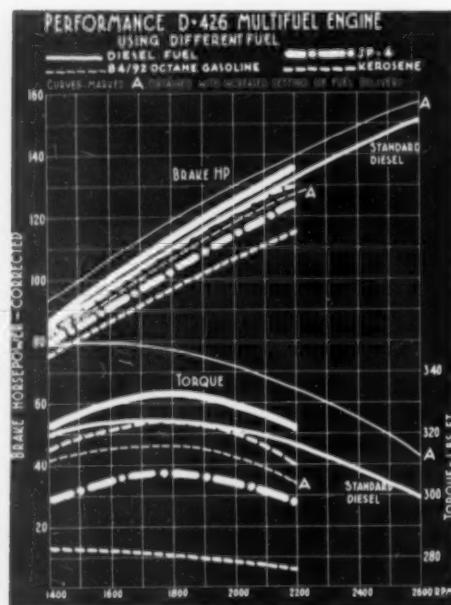
Dimensions of the aluminum V-8 Hercules Diesel

hp, six cylinder 3000 rpm engine is \$1400. List price of a 50 hp, three cylinder diesel is \$950. A general breakdown into what truck sizes the specific new Hercules diesel models can find application is as follows:

(1) 3000-6000 GVW trucks—model DD-149-H, rated 46 hp at 2600 rpm, 3 cylinders and measuring about 27 in. fan to flywheel with a stripped engine weight of 580 lbs. Also the model DD-169-H, rated 52 hp at 2600 rpm which has same basic dimensions as the DD-149-H but larger displacement for more horsepower.

(2) 6,000-12,000 GVW trucks—model DD-198-H, rated 72 hp at 2600 rpm, 4 cylinders and measuring about 32 in. fan to flywheel with stripped engine weight of 630 lbs. Also the model DD-226-H which has same basic dimensions but larger displacement to give 78 hp at 2600 rpm.

Performance curve of the multifuel model D-426 engine showing various fuels used.



(3) 12,000-24,000 GVW trucks—model D-298-H, rated 112 hp at 2800 rpm, 6 cylinders and measuring 41 in. fan to flywheel with stripped engine weight of 785 lbs. Also the model D-298-HT, which is a turbocharged version rated 150 hp at 3000 rpm with a stripped engine weight of 830 lbs.

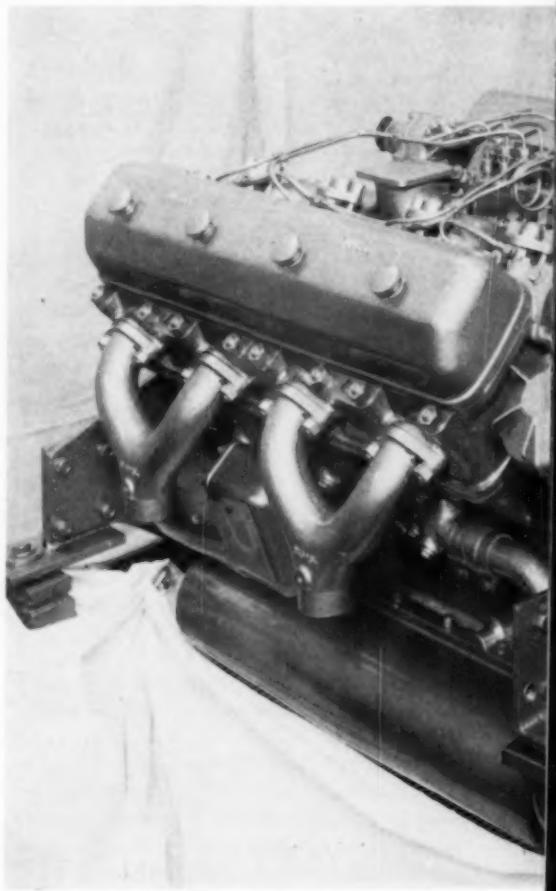
(4) 22,000-38,000 GVW trucks—model D-426-H, rated 145 hp at 2600 rpm, 6 cylinders and measuring about 45 in. fan to flywheel with a stripped engine weight of 1350 lbs. Also the model D-426-HT, a turbocharged version, rated 180 hp at 2600 rpm with a stripped engine weight of 1450 lbs.

These of course are only general matchings and the specific truck application will dictate exactly which engine should be used. But the engine ratings, sizes and weights available right now for truck repowering, and the prices quoted, show Hercules has something that looks very attractive for the medium and light truck fleet operation, and the taxicab fleet owner. Although service records are not yet available, Hercules engineers anticipate between 150,000 and 200,000 miles between major overhauls for the small truck diesels, and between 100,000 and 150,000 miles between overhauls for taxicab engines, primarily the three and four cylinder sizes.

The diesel engine is by far the most efficient prime mover available today. Engines like these at Hercules make it feasible for the fleet operator to buy small diesels. However, he will do well to be prepared to operate these small diesels with care and good preventive maintenance practices similar to those used by over-the-road fleet operators using the larger diesels. Only by following good operating practices will the medium and small truck fleet owner gain the maximum benefits of excellent reliability and low operating costs that the diesel engine offers.

Larger Automotive and Industrial Engines

Two new heavy duty automotive and industrial type engines have also been announced. These engines range from 200 to 350 hp with ability to take

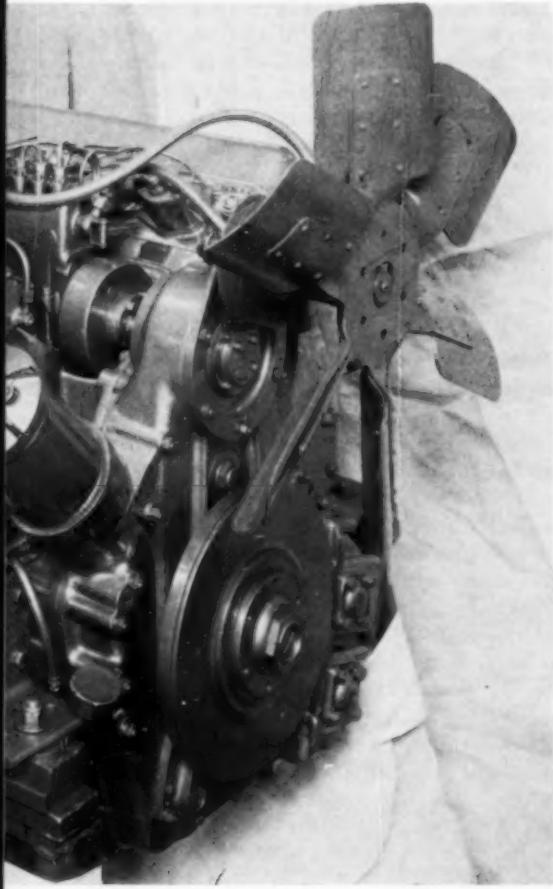


load capacities up to 76,800 lbs. GCW in trucking applications. Outstanding among these engines is a new all aluminum 2600 rpm V-8 engine weighing only 1540 lbs. (less electrical equipment, air cleaner and fan). This engine has a maximum rating of 225 hp at 2600 rpm naturally aspirated, has a displacement of 662 cu. in. and is a square engine with bore and stroke of 4.75 in. This engine, when turbocharged, has a maximum rating of 300 hp at 2800 rpm. The engine has the new "polydiesel" combustion chamber, which will be described in detail later, and from the accompanying power curves it can be seen that this unit has good fuel consumption characteristics of well under .40 lbs./bhp/hr. The diesel is also unique as it is a square engine and gets into higher speed

ranges as well as being aluminum with outstanding power to weight ratio of approximately 5:1.

The cylinder block and crankcase is in one piece cast from alloy aluminum with alloy iron wet type cylinder liners. The cylinder heads are also aluminum with one head for each two cylinders. The pistons are aluminum. The crankshaft has 5 main bearings with bearing diameter of 3.5 in. The single camshaft is set in the vee and serves both banks of cylinders, is chain driven and has 5 bearings 2.20 in. in diameter each. The connecting rods are side by side and 9.60 in. long. There

Aluminum Hercules V-8 diesel developing 225 hp at 2600 rpm and weighing only 1540 lbs. Note American Bosch fuel pump in vee. The turbocharged version of this engine is rated 300 hp at 2800 rpm. The engine has a displacement of 662 cu. in. and is a square engine with bore and stroke of 4.75 in.



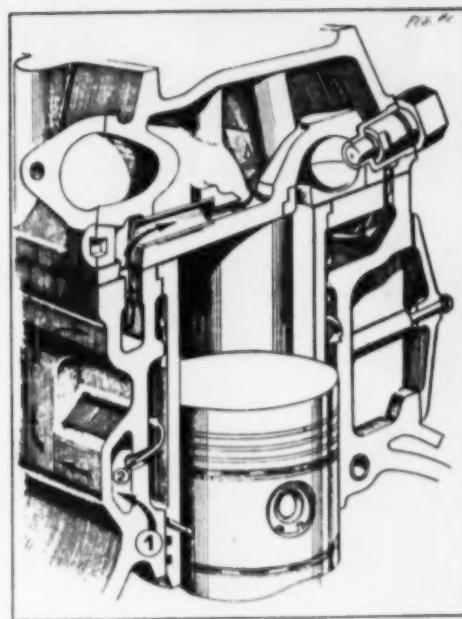
are three valves, two intake and one exhaust, and of course the special "polydiesel" turbulence combustion chamber in the head. The American Bosch individual plunger type fuel pump is gear driven from the camshaft and mounted inside the vee. Fuel injection nozzles are the pintle type. The fuel transfer pump is the gear type and the governor is a variable speed mechanical unit. A high velocity centrifugal gear driven pump is used for coolant circulation and lubrication is by gear type scavenging and pressure pumps inside the gear housing on the front of the engine. An interesting design feature is the integral with engine design of the main full flow lube oil filter and lube oil cooler. The second basic engine in this area is a new six cylinder, in-line 779 cu. in. diesel which

develops 240 hp at 2400 rpm, naturally aspirated. The turbocharged version develops 350 hp at 2400 rpm. This engine is designed for rugged long life service in larger over-the-road trucks and off-highway construction and industrial equipment.

Polydiesel Combustion System

Four of the new Hercules diesels feature the new "polydiesel" combustion system. These include the new aluminum V-8 diesel described above, both naturally aspirated and turbocharged and the new model D-426 diesel. This new engine is a six cylinder in-line unit with a displacement of 426 cu. in. and bore of 4.25 in. and stroke of 5 in. This engine's rating and weight naturally aspirated and turbocharged has been stated earlier so we will proceed right into a basic description of the unit. The cylinder block and crankcase is one piece cast alloy iron with special alloy iron dry type cylinder liners. The cylinder head is in one casting for the six cylinders. Pistons are aluminum. The crankshaft has seven bearings of 3.50 in. diameter and the chain driven camshaft has seven bearings of 2.06 in. diameter. The American Bosch individual plunger fuel pump is chain driven from the camshaft on the left side of the engine. Fuel injection nozzles are the pintle type. A high velocity centrifugal type pump serves the cooling system and lubrication is force fed by gear type pressure pumps inside the crankcase.

The new "polydiesel" combustion system has been developed by Hercules in cooperation with Hispano-Suiza of Paris, France and has been several years in development. The combustion system results in a very interesting multi-fuel engine as well as providing a fine engine for commercial straight diesel applications. The configuration of the combustion system featuring a turbulence chamber inside the cylinder head with a special insert is shown in the accompanying illustration of a cylinder head cutaway view on the model D-426 diesel. A pintle type fuel injection nozzle is used, which

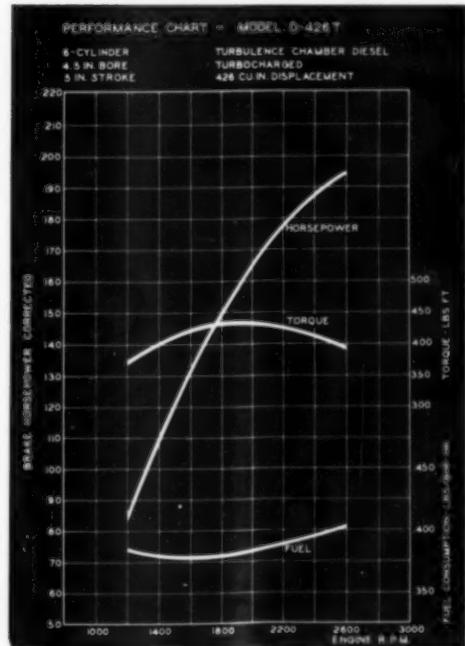


Cutaway view of cylinder in model D-426 diesel showing "polydiesel" combustion system in the cylinder head. Pintle type fuel injection nozzle is used. Note generous cooling passages around combustion chamber insert.

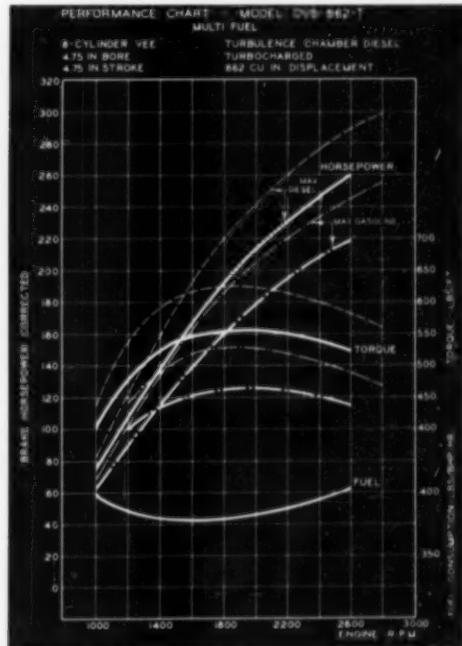
has the important advantage of inherently having long and trouble-free life characteristics.

Dr. E. A. V. Horiak, Director of Engineering at Hercules, in describing this new combustion reported as follows: "This new system resulted in a smooth running engine with an absolute minimum of diesel knock, but most noteworthy, it is also possible to refine fuel consumption heretofore credited only to direct injection open chamber type high speed diesels. This economy is obtained with an auxiliary chamber inside of the cylinder head where the spray pattern has only minor importance and where the pintle-type nozzle

Performance curve of the turbocharged model D-426 T diesel.



Performance curves on turbocharged aluminum V-8 diesel. Note fuel consumption curve.

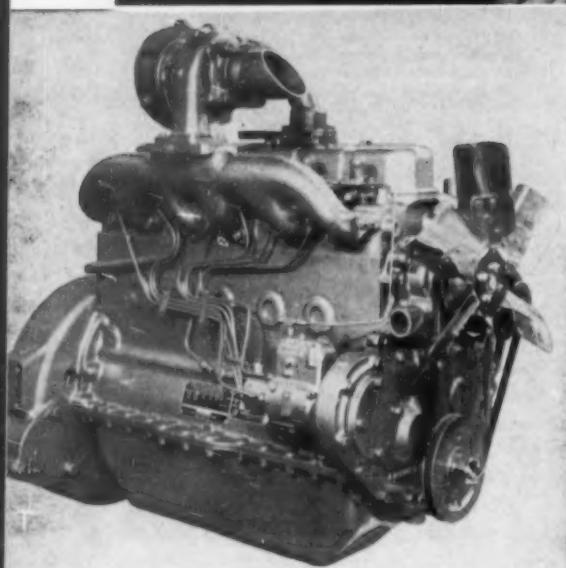




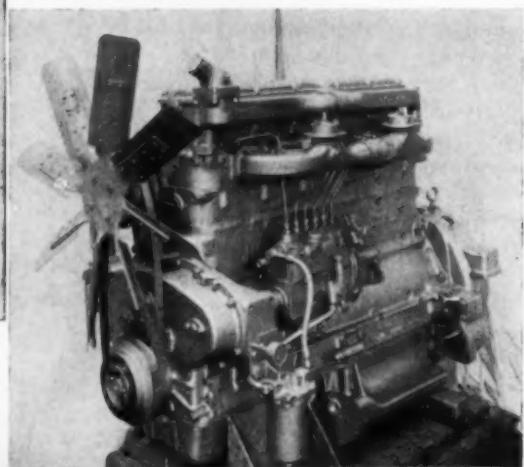
Dr. E. A. V. Horiak (right), Director of Engineering, points out to William L. Pringle, President, the specially-designed alloy insert which is the secret of the new Hercules "Polydiesel" combustion chamber. The chamber is already a feature of four of the new Hercules diesels.

is self cleaning. The exhaust of these engines at all speed and load conditions up to maximum curve horsepower is remarkably clear with a minimum of smoke as is generally characteristic of diesels with auxiliary combustion chambers."

"This new multi-fuel engine is a genuine all fuel type engine with no adjustments required to change fuels. A reduction in performance, however, is experienced when using fuels with a low cetane rating but these reductions are nominal. One of the most startling developments was the fact that this combustion system will burn gasoline successfully with a compression ratio as low as 17:1 and the turbocharged V-8 engine has a compression ratio of 17:1. The six cylinder engine, model D-426, incorporates a compression ratio of 17.5:1. We recommend, however, that a compression ratio of 18:1 to 18.5:1 be used for the best starting results in cold weather operations when using gasoline as a fuel."



New 6-cylinder, 779 cu. in. naturally aspirated heavy-duty diesel truck engine which develops 240 hp at 2400 rpm. When turbo-charged, it develops 350 hp. Note American Bosch fuel pump and Purolator fuel filter.



New 6-cylinder, 150 hp, model D-298-HT turbocharged Hercules diesel truck engine, weighing only 830 lbs., offers advantages of low weight per horsepower. Note AiResearch turbocharger and Roosa-Master fuel pump.



The "polydiesel" chamber in the head features special metallurgical qualities that keep the surfaces in excellent condition to promote good combustion. Also, with this chamber in the cylinder head, there is ample room for cooling passages to provide adequate cooling in the combustion chamber area. As a multi-fuel engine, the model D-426 was demonstrated for me. The engine idled very well on gasoline as slowly as 375 rpm at no load and made the transition from diesel fuel, to JP-4 jet fuel, to kerosene, and to gasoline with no trouble and was run on all these fuels at various loads. The engine performed very well and there were no changes or adjustments made as the engine ran on these various fuels. A power curve is illustrated showing performance on these various fuels in the D-426 engine. The multi-fuel abilities of these engines are particularly attractive to the military, which is very interested in multi-fuel engines for all types of mobile and stationary equipment using high speed, automotive type engines. The multi-fuel engine also has possibilities in commercial application, particularly in remote areas where ability to burn a variety of fuels may be important. In addition to the trucking field, these new engines will find application in construction, agriculture, material handling, general industrial areas and marine markets where their general features of lightweight, compactness, good operating speed characteristics for many mobile equipment applications and operating economy will be important.

Developments like these at Hercules will go far in broadening the market for diesels. Every commercial engine user should look to the diesel today for a potential profit producer as the operating cost-profit squeeze continues to become more acute. The diesel can and will be the answer to more successful and profitable commercial engine operations.

Hercules six cylinder diesel currently undergoing road tests in model 370 GMC truck in the 22,000 lb. class.



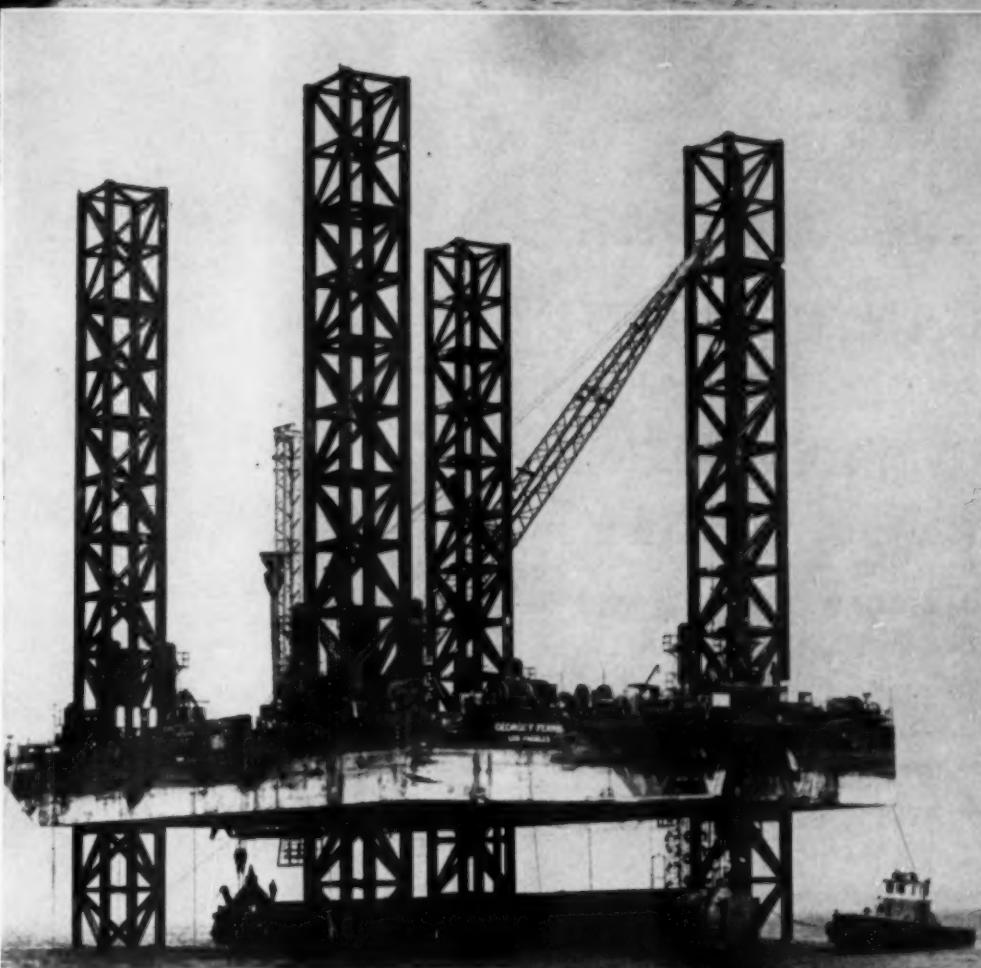
A long section of pipe is hauled out to sea by the *R. Thomas McDermott*. The tug has two Enterprise DMG-36 turbocharged engines rated 695 hp at 450 rpm.

1400 HP TUG TOWS 720 TON PIPE

THREE to five nights a week the diesel tug *R. Thomas McDermott* leaves a Long Beach (Calif.) pier towing a heavy cargo of concrete pipe on a seven-hour trip along the Pacific Coast to the Hyperian Sewage plant off El Segundo and Playa Del Rey. The pipe is for the \$21 million Hyperian pipeline to discharge waste water into the sea. This spectacular engineering feat involves the laying of 6.22 miles of large-size pipe; each section towed into place weighs 720 tons, is 192 ft. long and 14 ft. in diameter. Engineers of the pipeline believe that it is the largest, longest, heaviest and deepest ever assembled under water.

The *R. Thomas McDermott*, owned by the J. Ray McDermott and Co., San Diego, is powered by two Enterprise DMG-36 turbocharged engines rated 695 hp at 450 rpm. The *R. Thomas McDermott*'s present job is to tow an air-filled pontoon with a section of pipe slung under it to an offshore "tower". The \$5 million tower, a 27-story high floating platform, was custom-built by Pacific Coast Engineering and Kaiser Steel for laying the Hyperian pipeline. The platform is 210 ft. long and 120 ft. wide. Its deck is a maze of winches and machinery. A 100 ft. crane is positioned in the center.

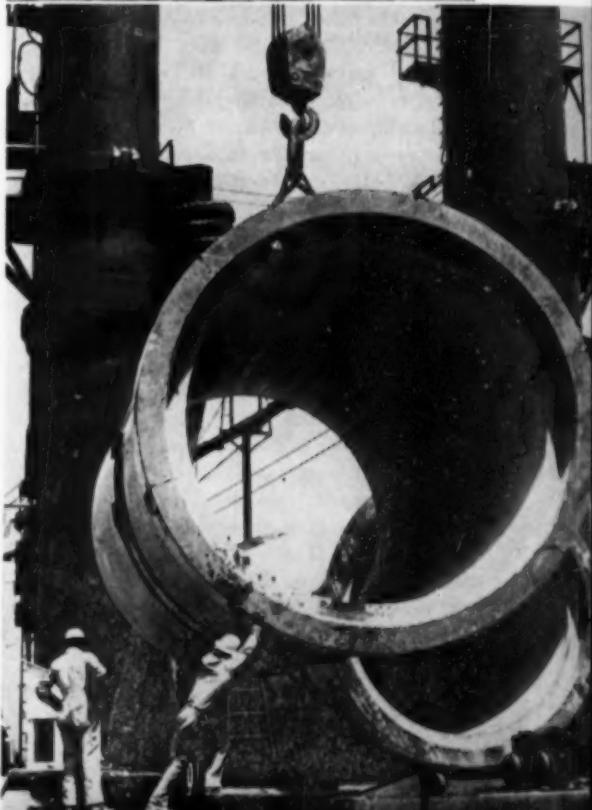
When the *R. Thomas McDermott* arrives with its tow, a tiny tug called the *Ant* assists in gingerly guiding the pontoon and pipe into position under the platform. Ten lines secure the pontoon to the platform. The pipe section is lowered to the ocean floor by flooding the air bubble of the pontoon with tons of sea water. Two divers ride the section down and guide it into place by calling up instructions to the winch operators. Once the spigot end is inserted into the bell, a rubber gasket inside the foot-thick pipe walls seals it under compression. With the pipe in place, a deck crane on the platform pours 1200 tons of rock down a chute. This cradles the pipe to prevent sand washouts and hold it to grade. When the pon-

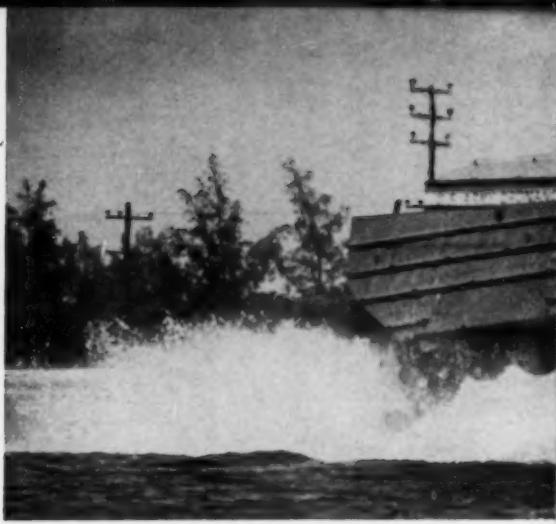
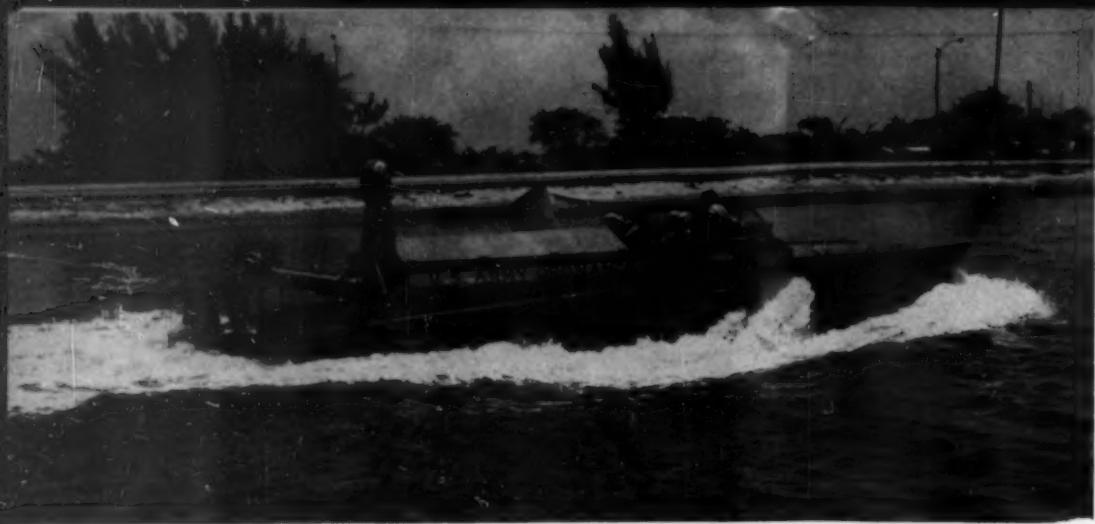


This \$5 million floating platform, with four 270-ft. towers, lays pipe on floor of Pacific Ocean for 6.22-mile long Hyperian line.

A 90-ton section of pipe is fitted into another at Long Beach. Finished 192-ft. long section, weighing 720 tons, is towed by the *R. Thomas McDermott* to floating platform.

toon is surfaced, the *R. Thomas McDermott* pulls it back to Long Beach. The floating platform, built in San Francisco Bay, was towed south along the coast in an unusual, spectacular and ticklish operation. Seven tugs of the Red Stack Towing Co., two of which were the new ocean-going *Sea Witch* and *Sea Giant*, towed the platform. The *Sea Witch* and *Sea Giant* each is equipped with an Enterprise DMR-38 diesel engine rated 2000 hp at 900 rpm. The structural steel legs on the platform are 270 ft. long. Each time a section of pipe is laid, the legs are jacked up and the platform is floated out another 192 feet for the next splicing operation. Then the legs are drilled back into the sandy bottom and the platform is hydraulically jacked up clear of the water. The pipe is being laid by the Hyperian Constructors, a joint venture of six firms. Raymond International, Inc., is the sponsoring company. The project is scheduled to be completed early in 1960.





GAS TURBINE DRIVES FLYING DUCK FOR ARMY

860 HP Lycoming T53 Engine Powers Amphibious Craft; Unique Concept May Well Answer Military's Demand for Increased Speed and Mobility of Attack Vessels

A TRUCK that floats like a boat and "flies" like an airplane—the "Flying Duck"—has been unveiled by the U.S. Army. Developed by AVCO Corporation's Lycoming Division, Stratford, Conn., under a contract with the Army's Ordnance Corps, the "Flying Duck" is a gas turbine driven, hydrofoil version of the famed World War II DUKW, an amphibious landing craft familiar to soldiers who served in both the Pacific and European theaters. The "Flying Duck" uses its 860 hp Lycoming gas turbine engine, which normally powers helicopters and airplanes, in combination with aerodynamically shaped hydrofoil wings to attain water speeds up to 50 mph. The World War II version had a maximum water speed of 6 mph.

The "Flying Duck" flew successfully for the first time in August 1959 at the test site of Miami Shipbuilding Corp., a major participant in the development program. On water, the "Flying Duck" begins operation in much the same fashion as a conventional boat. When it reaches a speed of 5 mph, however, water flowing around the hydrofoil wings (which are extended below the surface) acts in the same manner as does air flowing past an airplane wing. The pressure above the foil, reduced in relationship to the pressure below, produces lift. At 13 mph, this lift is sufficient to raise the vehicle well out of the water. At full flight condition, the hull is more than 4 ft. above the surface. The three hydrofoils, two forward and one at the rear, travel approximately 30 in. below the surface.



"Flying Duck's" compact power package is a Lycoming T53 gas turbine rated 860 hp. This engine normally powers helicopters and airplanes. Design of the engine began in 1951. The short stack is all that protrudes after installation in the "Flying Duck".

Lycoming T53 gas turbine engine is installed in the "Flying Duck" with the power turbine shaft facing the rear. It is coupled directly to the gear box of the over-the-stern drive. A 3000 psi hydraulic pump is mounted above the engine shaft.

With the hull completely out of the water, more than 60 per cent of the drag normally associated with boats is eliminated, thereby allowing for the large increase in speed. The "Flying Duck's" ability to maintain these high speeds over long and rough water hauls provides its greatest single advantage over conventional craft, Lycoming explains. Another advantage is the lack of seasickness-causing motion. This is accomplished through the use of an automatic pilot which senses the waves ahead and then controls the foils to com-



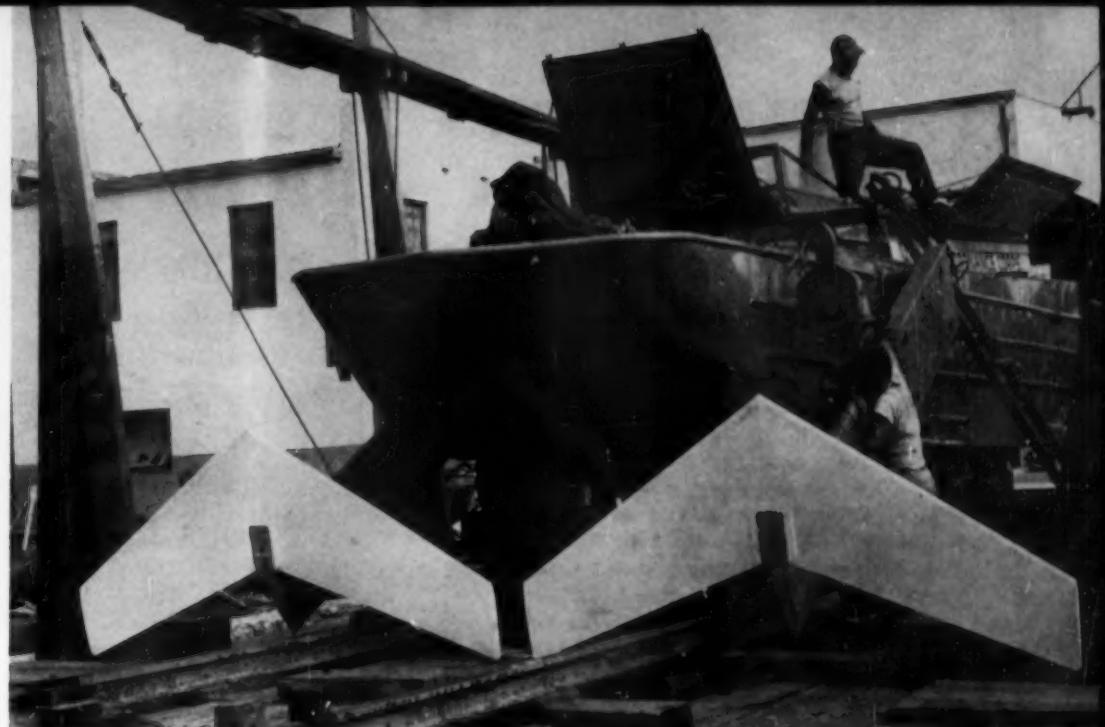


Traveling 4 ft. above the water when in full flight condition, the "Flying Duck" is capable of reaching speeds "in excess of 40 mph."

pensate for any variations, even in relatively rough water. The two forward foils are hinged at the rear to allow their angle to be controlled either manually or automatically.

The "Flying Duck's" multi-fuel engine can operate on diesel fuel, kerosene, gasoline, jet fuels or any combination of these. The Lycoming T53 engine is the same model currently being used in the Army's new Bell HU-1 helicopter and Grumman AO-1 observation aircraft. This marine version is its second industrial usage. Company officials predict that it will also find acceptance in other ground applications. Advance in the state of the hydrofoil art is expected to accelerate in the next few years because of the light weight, high power and high torque characteristics of the gas turbine engine, Lycoming believes.

Ultimate aim of the Ordnance Corps in awarding the contract to AVCO Corp. a year and a half ago was twofold: 1, to demonstrate that wheeled amphibious vehicles could be operated on hydrofoils and to join successfully this combination to a gas turbine engine; and 2, to develop a vehicle that could carry cargo and personnel over long, rough water hauls at high speeds with a high degree of maneuverability. The "Flying Duck" type



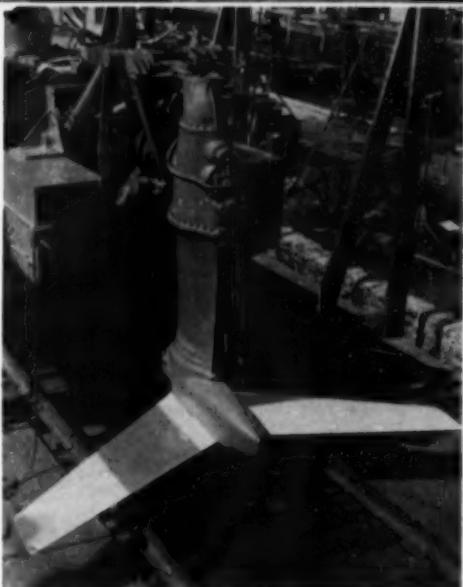
Each of the twin forward hydrofoil wings, shown being installed, measures just short of 9 ft. in span and weighs approximately 600 lbs. The foils are connected to the struts by means of a hinge pin which permits changes in the angle of attack. The angle is controlled either manually or through an automatic pilot.

Rear strut of the "Flying Duck" measures approximately 10 ft. across.

of vehicle, in addition to a water speed of 50 mph, can operate for approximately 5 hrs. with a range of 250 miles. It can also operate on the high seas from a "mother" ship. Much of the "Flying Duck" program was performed by Miami Shipbuilding Corp. under subcontract from Lycoming. The test program thus far has been jointly conducted by engineers of Lycoming and Miami Shipbuilding in waters off the Miami coast. Advanced hydrodynamic studies and tow tank model tests were conducted by Stevens Institute of Technology.

All branches of the military services are actively interested in the program, Lycoming said. The "Flying Duck" is among the few existing surface vessels capable of catching an atomic submarine. It can maintain level high speed flight in choppy sea conditions of 4 ft. waves as well as negotiate rough ocean seas and surf. The World War II DUKW had a maximum gross weight of 19,000 lbs., whereas the "Flying Duck" has already "flown" at 26,000 lbs. gross. Among possible assignments for the vessel would be anti-submarine patrol, air-sea rescue duties, a mobile missile launching platform and as a platform from which to launch frogmen operations. In amphibious invasions, it could transport cargo and troops from 100 miles out at sea to inland dumps in 2 hrs. rather than the 14 hrs. previously needed.

Experiments with the hydrofoil principle were conducted as long as 50 years ago. Of several models built, all proved to be either expensive, unwieldy or otherwise impractical. Several commercial models are in limited use today in various parts of the world; hundreds more are used on very small racing boats. These are primarily of a



highly simplified form, however, and are impractical for military or wide-scale commercial use.

AVCO's Lycoming Division has been engaged in amphibious vehicle and hydrofoil activity for several years. During World War II it built for Army Ordnance a then-secret high speed amphibious vehicle known as the "Salamander". More recently, Lycoming provided a T53 gas turbine engine to Miami Shipbuilding Corp., which was engaged in the conversion of a Navy LCVP to a hydrofoil configuration. This vehicle, called "Hallobates", was designed only to test the feasibility of some advanced hydrofoil design. It successfully flew for the first time early this year at a speed in excess of 35 mph.

Like the "Flying Duck", the T53 engine is also an Army-sponsored development, along with some initial Air Force funding. The design of this engine began in 1951 primarily for helicopters and fixed wing aircraft. Early in its design cycle, both the Army and Lycoming foresaw the advantages it offered for marine applications.



EMERGENCY POWER FOR MIAMI AIRPORT

Caterpillar and Waukesha Diesel Generating Sets Ready to Cut in Immediately if Regular Power Sources Should Fail at New \$80 Million Facility

By ED DENNIS

THOUSANDS of passengers each week enter or leave the famed "Gold Coast" city of Miami through the new \$80 million International Airport—"aerial gateway to Latin America." The airport is 3000 acres of sand, rock and concrete runway. As his plane taxis in, the passenger beholds a magnificent \$26 million terminal.

Designed and built for the jet age, the new airport has grown from 233 acres in 1946 to its present 3000 acres. It is served by 27 scheduled lines and 33 irregular carriers. An aircraft lands or takes off from Miami Airport—one of the nation's busiest—every 84 seconds. More than 11,000 passengers are accommodated daily. The airport is a large base for the maintenance and overhaul of commercial aircraft from all over the world. The airport creates direct employment for more than 20,000 persons.

The 2000 ft. long terminal sprawls over 80 acres, 74 aircraft can be loaded or unloaded at the 74 gates which emanate from six fingers. The terminal has 23 escalators and numerous elevators;

passengers depart on the upper level and arrive on the lower level. Ticket counters stretch 1500 lineal feet.

What the passenger or casual visitor does not see are the power sources that help insure the precise and efficient operation of Miami International Airport. Three completely independent energy sources, all underground, supply the airport's electrical needs. If any one source fails, the load automatically shifts to another source. Should all three sources fail—perhaps during a hurricane or some other disaster—the energy load would be assumed by several fully automatic diesel generating standby sets capable of operating indefinitely. Central control boards on the ground floor of the terminal building constantly record and analyze the workings of the entire power system. They warn of any impending functional difficulties.

Engineers set rigid specifications for the standby sets. They required that each set automatically start and connect to the power system and develop its rated output within six seconds from instant



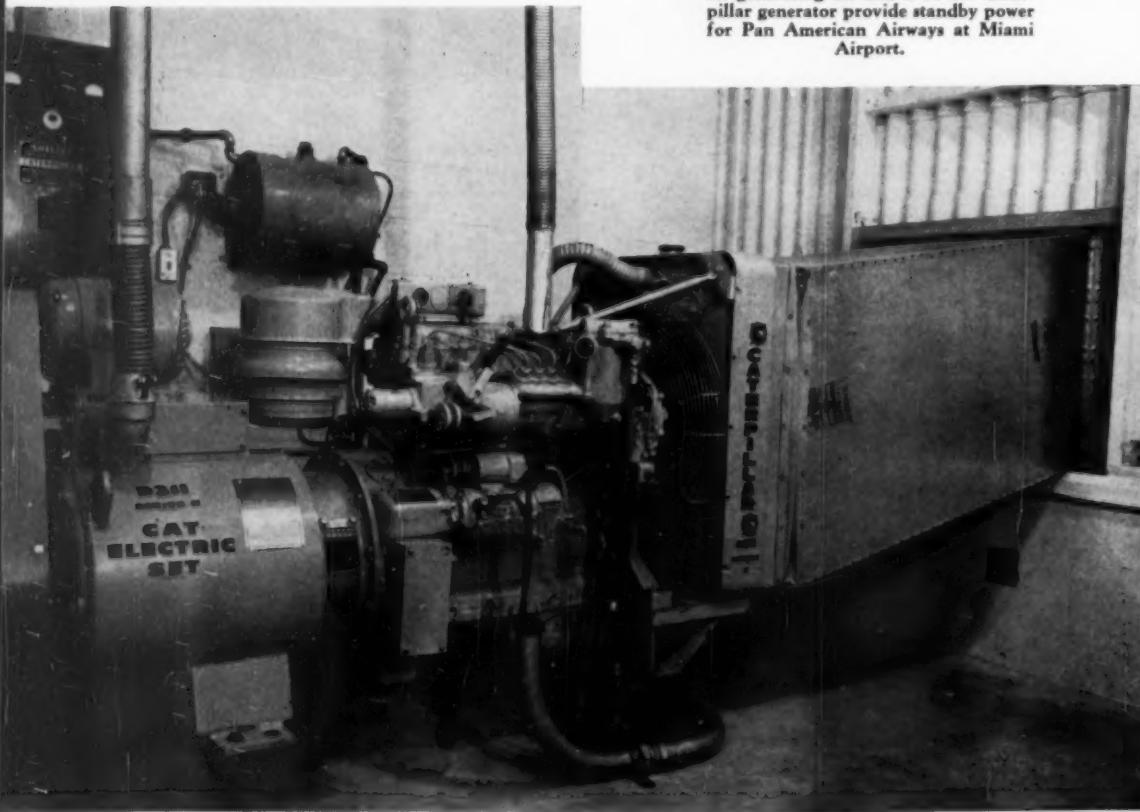
Artist's conception of the new Miami International Airport terminal.

of power failure. The sets are further required to provide their continuous full load operation for weeks, or even months, without shutdown.

First of the emergency generating units installed was a Caterpillar model D397, series D, V12 4-cycle diesel engine with a 375 kva, 300 kw 60 cycle, 1200 rpm Columbia Electric generator and a 4 kw, 125 volt, 32 amp exciter. The installation also included Eseco starting electric controls. The D397 has a piston displacement of 2493 cu. in. The foundation is of reinforced concrete with steel I beams and Korfund vibration isolators. During a simulated load test run for this author, the Woodward UG8 governor held the load perfectly; no cycle fluctuation or voltage drop could be detected to any degree. The sensitivity of the governor must be "perfect" because of the type of machines, such as teletype, which would draw power from this standby unit.

This generating set stays on for three minutes after regular power is returned. A simulated two-hour test is run each week. Engine cooling is obtained by a Ross heat exchanger and a fresh water well system. Discharge water goes into the

Model D311 series H Caterpillar diesel generating set and a 30 kw Caterpillar generator provide standby power for Pan American Airways at Miami Airport.



DIESEL AND GAS ENGINE PROGRESS



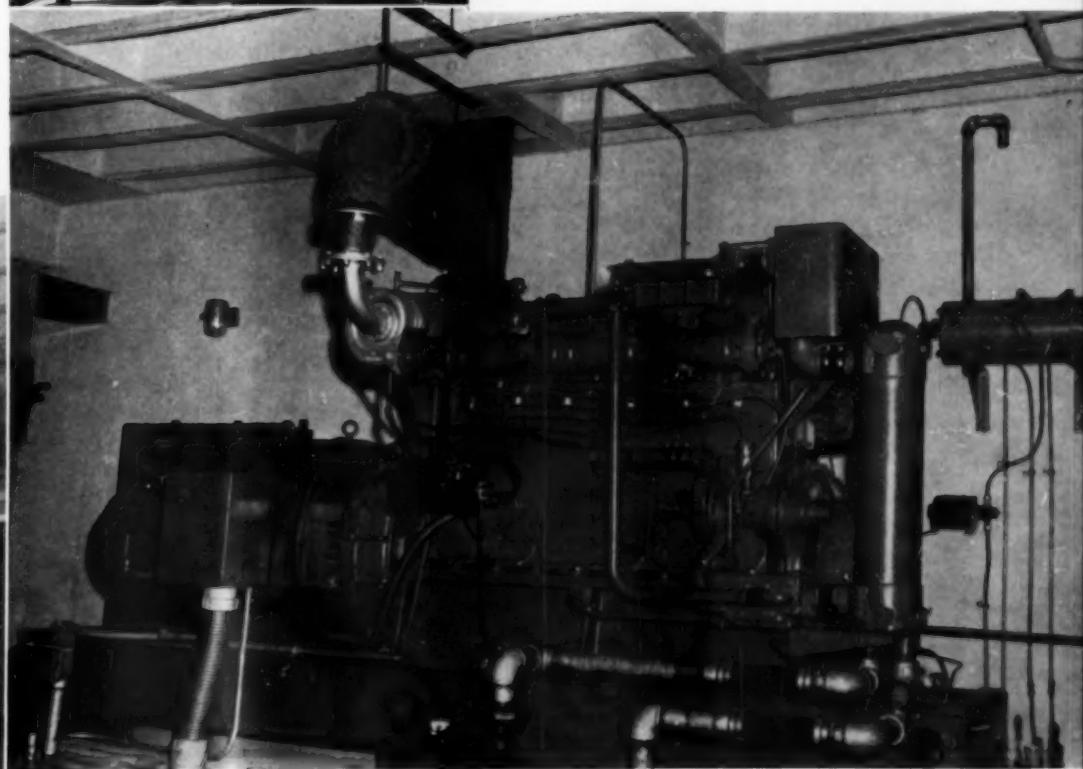
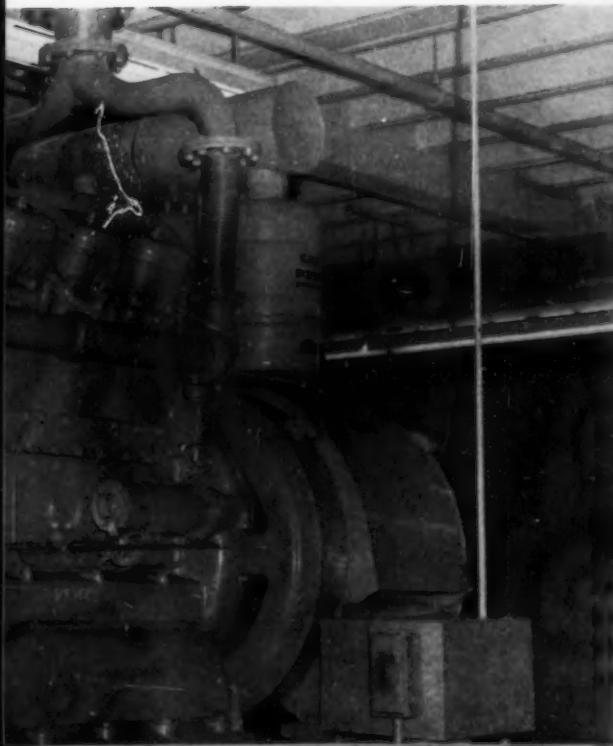
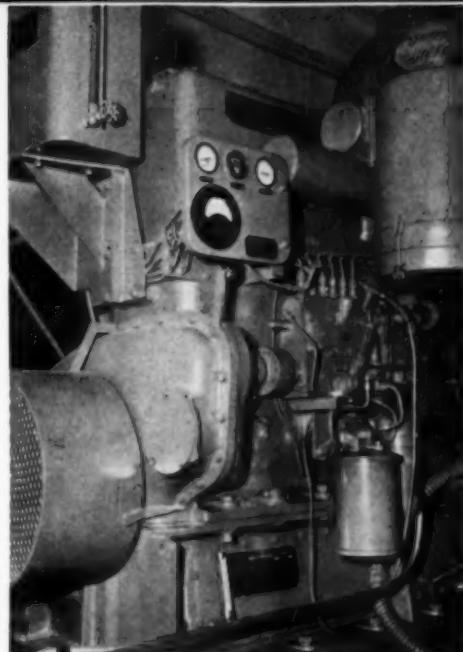
storm sewer drainage system. The plant would provide lights for the plane ramp and ticket takers; every 12th light in the building; and the post office, in addition to powering one elevator. Approximately 60,000 lights are in the terminal.

The second diesel generating unit to be installed was a Waukesha Enginator model 6NKDBS diesel, rated 390 hp at 1200 rpm, with a 225 kw, 60 cycle, 338 amp, 227/480 volt, 282 kva Electric Machinery synchronous generator. The exciter plate reads 125 volts, 20 amps. A Ross heat exchanger and a fresh water well system provide engine cooling. The engine foundation is constructed of rein-

Model 6NKDBS Waukesha diesel engine has American Bosch fuel injection and governor systems, Vortox air cleaners and Alnor pyrometer.

Turbocharged Waukesha diesel, rated 390 hp at 1200 rpm, along with 225 kw Electric Machinery generator, Ross heat exchanger and one of the Delco Remy starters.

Airport's model D397 series D Caterpillar diesel generating set with Columbia generator, Donaldson air cleaners, Woodward UG8 governor and Ross heat exchanger. Korfund vibration isolators are used in the foundation.



forced concrete with I beams and six Korfund vibration isolators.

The fuel injection system and governor setup is American Bosch. Two Vortox air cleaners are utilized, along with two model 1664-B-51 Winslow lubricating oil filters. The engine, equipped with a synchro-start, speed-sensitive switch, starts immediately on a power failure. A time delay element has not been rigged to this set yet. Two Delco-Remy starters are used. Simplex Sales Co. of Miami secured the engines for the airport.

Several airlines are installing standby plants in their own areas. First to be installed was a model D311 series H Caterpillar diesel set with a 30 kw, 104 amp. Cat generator. Shelley Tractor & Equipment Co. engineered this installation for Pan American Airways.

List of Principal Equipment Serving Engine-Generator Sets

Engine	Caterpillar
Generator	Columbia
Governor	Woodward
Heat exchanger	Ross
Air cleaners	Donaldson
Switchboard	General Electric

Engine	Waukesha
Generator	Electric Machinery
Fuel system & governor	American Bosch
Heat exchanger	Ross
Air cleaners	Vortox
Lube oil filters	Winslow
Pyrometer	Alnor
Switchboard	Westinghouse

(The author wishes to thank Mr. M. F. Holman, airport electrical supervisor, and Airport Commissioner Joseph Boyd for their efforts and assistance).

AUTOMATIC CRANKING SYSTEM, TANDEM PSB PUMP INTRODUCED

TWO new products, both tailored to meet very specific requirements of the diesel and gas engine industry, have been announced by the American Bosch Division of American Bosch Arma Corp. Officials at Springfield attach great importance to the developments—one, a new, larger version of the established PSB pump for eight and twelve cylinder engines, and—two, an automatic hydraulic cranking system for reliable, split-second starting of emergency engine-driven generating sets. Let's take a closer look at these products—their design, application and operation.

The new fuel distributor-type injection pump, designated PSB 12BT in its 12 cylinder model, is now in production and in a modified version, has been adopted as standard for the new 750 hp Continental 12 cylinder 1790 multifuel engine which will be used in the new M60 tank. The basic pump incorporates many of the proven features of the present single plunger PSB pump of which nearly one-quarter million have been produced in four and six-cylinder models. It consists of two six-cylinder hydraulic heads mounted in tandem (the eight outlet pump would be supplied with two four-cylinder heads). To insure uniformity of de-

livery, the two heads are balanced by an adjustable linkage connecting the two control unit levers. Incorporated in each replaceable hydraulic head is a single delivery valve and plunger, the latter being driven by separate multi-lobe cams and gearing from a single drive shaft. The housing, of cast aluminum, contains the camshaft which in the 12 cylinder pump has two cams, each with three lobes of 6 mm. lift.

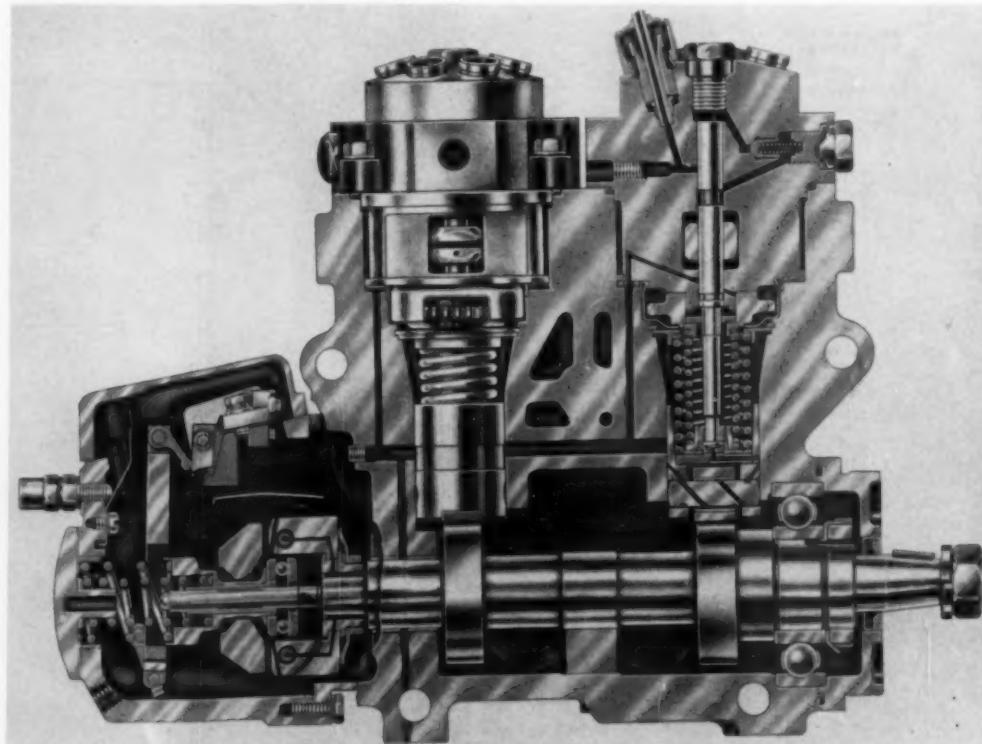
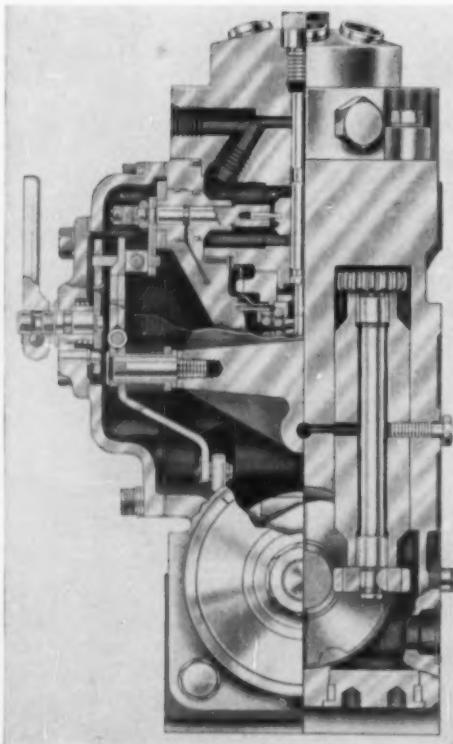
In its multifuel version, the specified plungers are 17 mm., but the basic pump is made with plunger diameters from 10 to 15 mm. The correct size for a specific engine application, however, is dependent on the fuel quantity and on the injection duration. For most applications, including energy-cell and high speed open chamber engines, theoretical durations of 8-10 crank degrees are used, and up to 14 degrees is applicable for pre-combustion chamber engines. According to Bosch, actual spray durations from the nozzle may be two or three times the theoretical duration.

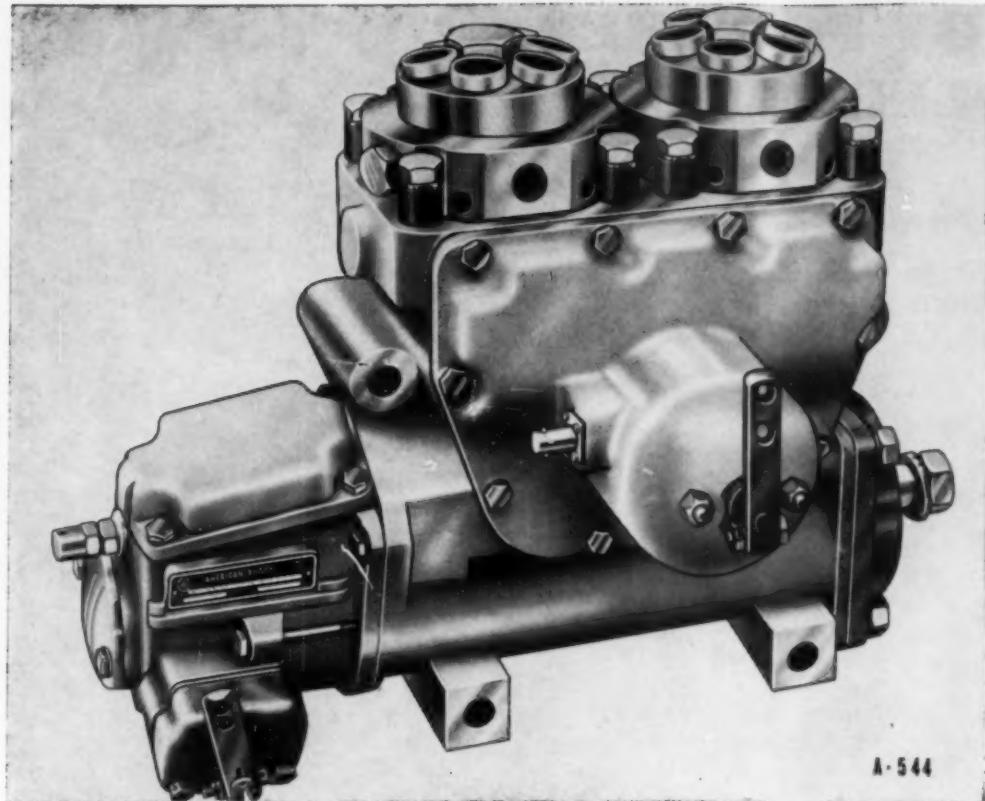
In the basic pump, a standard PSB-EH type mechanical centrifugal, variable speed governor is mounted at the left end of the pump housing and

is driven directly from the pump camshaft without gearing. For multifuel engine application, a fuel limiting arrangement is incorporated. This feature momentarily prevents excessive fuel delivery at intermediate speed settings of the operating lever. Operating lever movement from low to higher speed positions provides air fuel deliveries within the air capacity of the turbocharger. This is a factor in attaining clear exhaust since the device prevents full load deliveries before the turbocharger has attained speed.

These pumps are applicable to normally aspirated four cycle engines with a displacement volume per cylinder of up to approximately 550 cu. ins. which includes engines with about 8½ in. bore by 10 in. stroke. American Bosch engineers state that the required fuel quantity per cylinder per stroke should not exceed 500 cu. mm. For supercharged engines the cylinder displacement that could be handled would be correspondingly less. As with other PSB's, the pumps should be driven at crankshaft speed on four cycle engines and twice crankshaft speeds on two cycle engines. The pump is designed to receive pressure lubrication from the engine to which it is applied.

Cross sections of the new American Bosch 12-cylinder, tandem head PSB 12 BT distributor-type fuel injection pump. Although larger than the standard PSB, operation of the hydraulic heads is identical.





A-544

Automatic Cranking System Uses Hydrotor Motor

Developed for use with the American Bosch Hydrotor cranking motor, the new ASA automatic cranking system should find sound application in remote power stations, isolated communication relay centers, hospitals and other areas where emergency, engine-driven generating sets are required. The system consists of a bank of hydraulic accumulators, an electric pump for automatically keeping the accumulators charged to proper pressure with hydraulic fluid, a power operated control valve and a reservoir for hydraulic fluid. This equipment can be grouped together as one unit in a compact housing as illustrated here or the various components can be installed separately.

When applied to an emergency engine-generator system and tied into the electrical circuit being protected, any failure in electric power triggers a set sequence of events. First, a solenoid (which while energized has been holding the operating valve shut) becomes de-energized and the operating valve opens. This releases hydraulic fluid under high pressure to the hydraulic cranking motor which immediately cranks the engine. When the engine starts and the line voltage rises to normal, the solenoid closes the valve and shuts off the cranking motor.

For protection against the possibility that the solenoid could be de-energized by a temporary drop in voltage, as when a heavy load is thrown on

Here is the American Bosch multifuel pump which will be used as standard equipment on the 750 hp Continental engines powering the M-60 tanks.

Looking over the new ASA automatic cranking system are, left, American Bosch Speciality Sales Manager, John R. O'Donnell; and Vice President and Division Manager, Sidney E. Miller.



Trailer mounted ASA system is a prototype developed for demonstration in various parts of the country. This is similar to the way the Hydrotor was introduced.

the line, a piston also holds the control valve shut. The piston is actuated by engine lube oil pressure which automatically prevents the cranking motor from being operated while the engine is running. This use of lube oil pressure also gives protection in case the engine hesitates or slows down when first being started. As a matter of fact, if it does actually stall, a time delay of 10 to 12 seconds (while the lube oil pressure subsides) is provided before the control valve is permitted to open and crank the engine. This assures further protection for the cranking motor and flywheel ring gear teeth. Bosch recommends that a reserve bank of accumulators be included in the cranking system for emergency use if starting trouble is encountered. A hand pump is also specified for the same reason. By operating control valves by hand, the engine can be barred or jacked over for purposes of inspection, checking timing, etc.—a convenient maintenance feature.

The mobile unit shown is a prototype developed mainly for general demonstration and does not necessarily indicate the final appearance of the equipment. Another prototype installed in an ocean tanker for test purposes has been in service for more than a year and has been routinely operated once a week.

NORTHERN FERRY POWERED WITH AIR COOLED DIESEL

Ferry In Northern Michigan Is Repowered With 75 HP Deutz Air Cooled Diesel Giving Top Performance In Difficult Operating Conditions

By BRUCE W. WADMAN

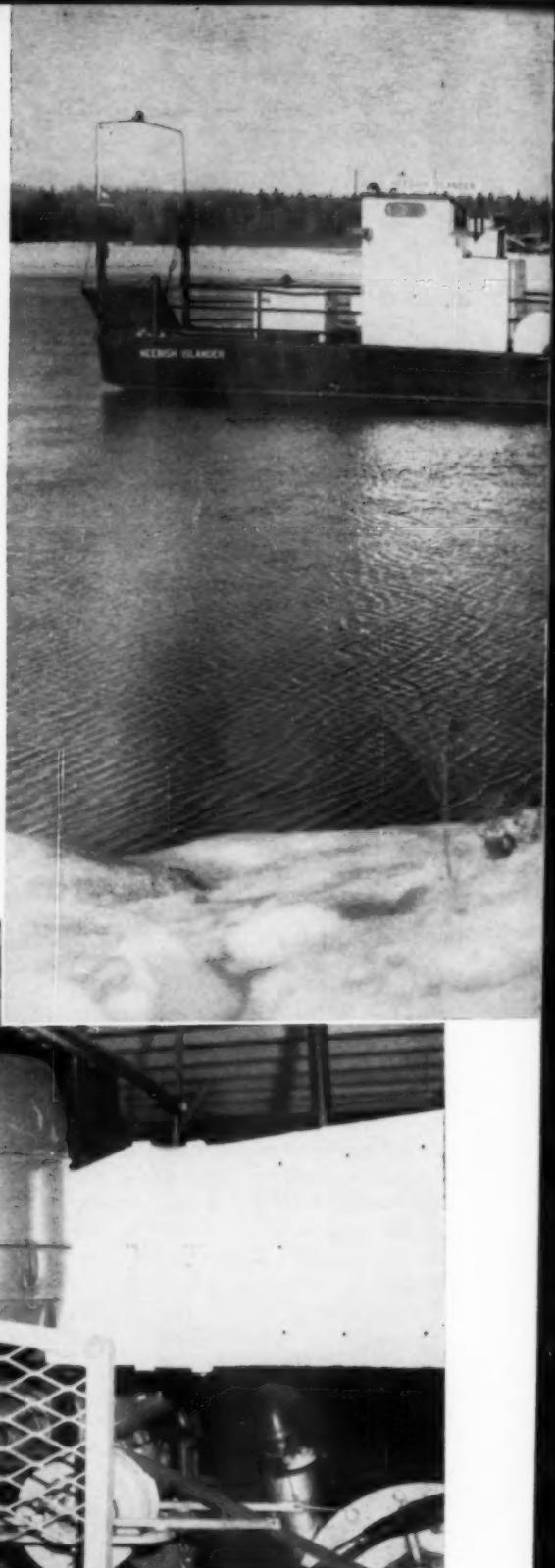
I RECENTLY travelled up to the tip of Northern Michigan near Sault Ste. Marie to examine one of the first installations in this country of an air cooled high speed diesel marine propulsion unit. The engine is a Deutz six cylinder four cycle in-line diesel with a normal continuous rating of 75 hp at 1500 rpm and it has replaced an old 60 hp diesel engine. As reported in the July 1959 issue, this is one model of a complete line now being marketed by Chrysler.

The engine is installed in small car and passenger ferry, *Neebish Islander* as the main propulsion unit. The ferry plies a route of about one-half mile between the mainland near the town of Barbeau, Michigan and Neebish Island. Neebish Island is 20 miles below Sault Ste. Marie and right in the main channel used by ore carriers and other vessels between Lake Huron and Lake Superior in the Great Lakes. Neebish Island is noted as a vacationland and a prime hunting and fishing area. It boasts some of the best hunting and fishing in Northern Michigan. Deer are abundant and bass, walleyes, northernns and perch are plentiful in waters around the island.

Fred Miller and Cliff Tyner operate the Neebish Island Ferry Service and own the *Neebish Islander*. The ferry was built in 1951 in Sault Ste. Marie and is 54 ft. in length and 22 ft. in width. It has a gross load rating of 49.3 tons. The ferry is open-

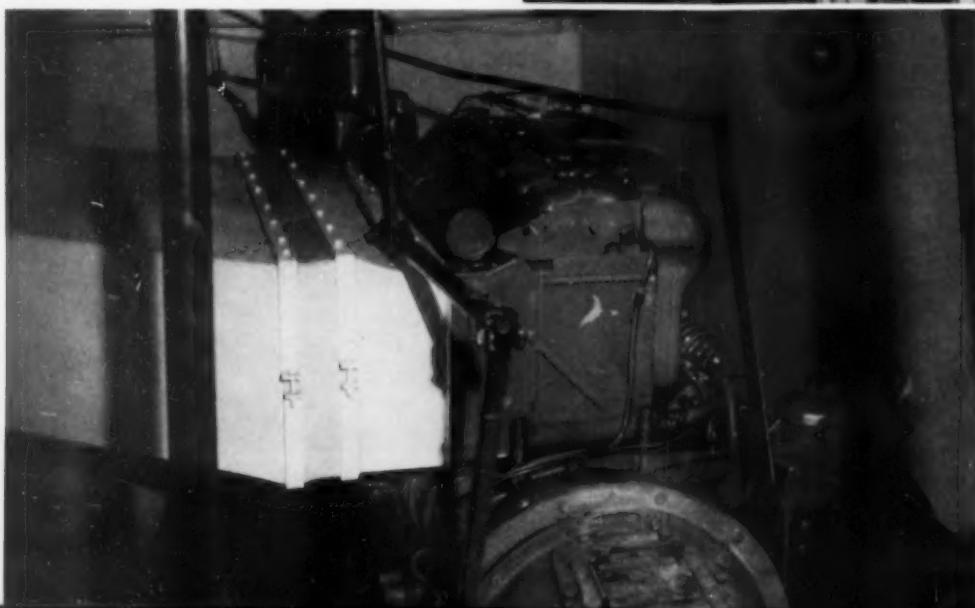
ended with a pilothouse situated on the port side amidships. It was repowered with the Deutz diesel in March of this year.

The *Neebish Islander* is the only source of transportation between the island and main land and



▲ Closeup of front of engine with air shroud at right.

◀ Rear view of Deutz engine showing control linkage from Twin Disc r&cr gear and engine to pilothouse. Cooling air is taken from engine room through engine driven fan and manifold at right, forced through cylinders and out through shroud at left and up the exhaust stack.



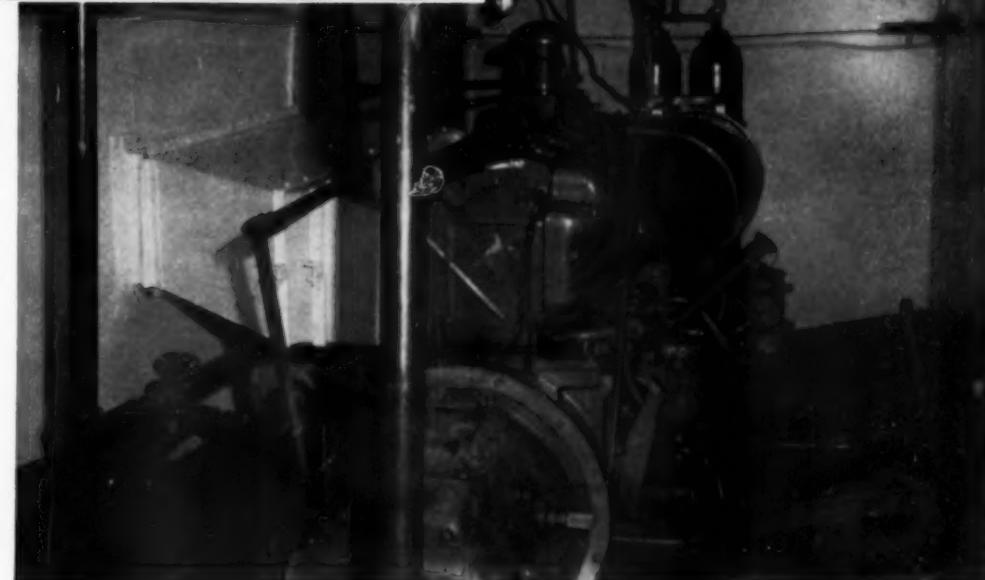


the Neebish Island population must rely on it; therefore the ferry is on call 24 hours a day. Neebish Island reaches a peak of population between 500 and 600 during hunting and vacation seasons and drops down to about 60 during the winter. The *Neebish Islander* definitely plays an important part in the lives of the people in this picturesque and isolated area and she must deliver the maximum in operating reliability.

Besides her normal duties, the *Neebish Islander* has played a stalwart role in the St. Lawrence Seaway development project. Two large dredging firms, Great Lakes Dredging and Dunbar and Sullivan, have been working on deepening the main channel for ocean going vessels in the Neebish Island area and the ferry has transported men and materials engaged in this project.

Details On Engine Installation

An air-cooled diesel was selected for repowering the ferry for several reasons. The owners had some problems in the ferry operation that make it tough on an engine. The *Neebish Islander* makes the short one-half mile run in three minutes and the engine is normally shut down between runs. In Northern Michigan, there is plenty of cold weather and the previous engine didn't run long enough to operate at good temperature levels. The Deutz air cooled engine, with a standard glow plug starting aid, starts and idles well in cold weather and achieves good operating temperatures quickly. In the installation, the heat exchanger, sea water pump, fresh water pump and plumbing for the cooling system were eliminated, and a



shroud was installed to take cooling air after it passes through the engine out of the engine room and into the exhaust stack. This is necessary in an air cooled diesel installation in closed quarters to insure adequate air circulation for the engine. This engine has a cooling air requirement of 2500 cfm at 1500 rpm. The ducting arrangement, however, is relatively easy to install. Air for cooling is taken from the engine room by an engine driven fan that forces the air around the cylinders and out through the shroud.

This engine is the four-cycle Deutz model SA6L514 with a bore of 4 1/8 in. and stroke of 5 1/2 in. and displacement of 487 cu. in. The power train con-

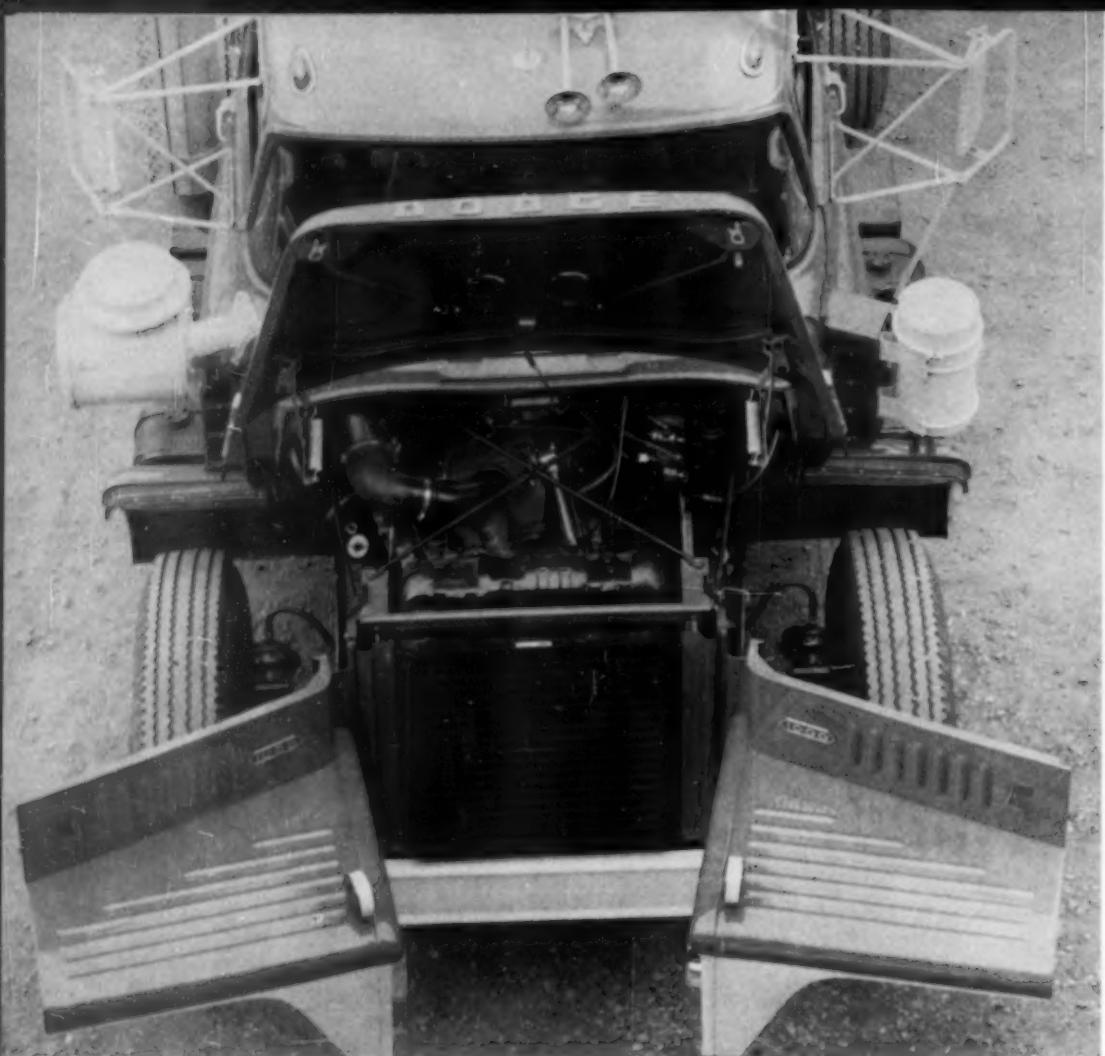
sists of a model MG61 Twin Disc 3:1 reverse and reduction gear, a 15 ft. 4 in. shaft and a 3 blade 36 x 27 propeller. The engine is controlled completely from the pilothouse. The engine room is literally as clean as a whistle and the owners can be proud of it. Accompanying illustrations show this well kept engine room. The excellent care that is taken of the diesel certainly contributes in no small way to its successful operation. So far the Deutz diesel has logged in excess of 600 hrs. and is running fine. The owners in evaluating the engine's performance state, "This air cooled diesel

The *Neebish Islander* in one of its trial runs following repowering in March 1959. Vessel is 54 ft. long and is owned by Fred Miller and Cliff Tyner. Deutz engine was sold and installed by David A. MacPherson, Iron River, Mich.

Good view of the 75 hp Deutz diesel installation in the ferry, *Neebish Islander* looking forward in the engine room. Note Twin Disc 3:1 r&r gear, Robert Bosch fuel injection equipment and Fram lube oil filter. Shroud to take cooling air out of engine room is shown at left. Note cleanliness of engine room and installation.

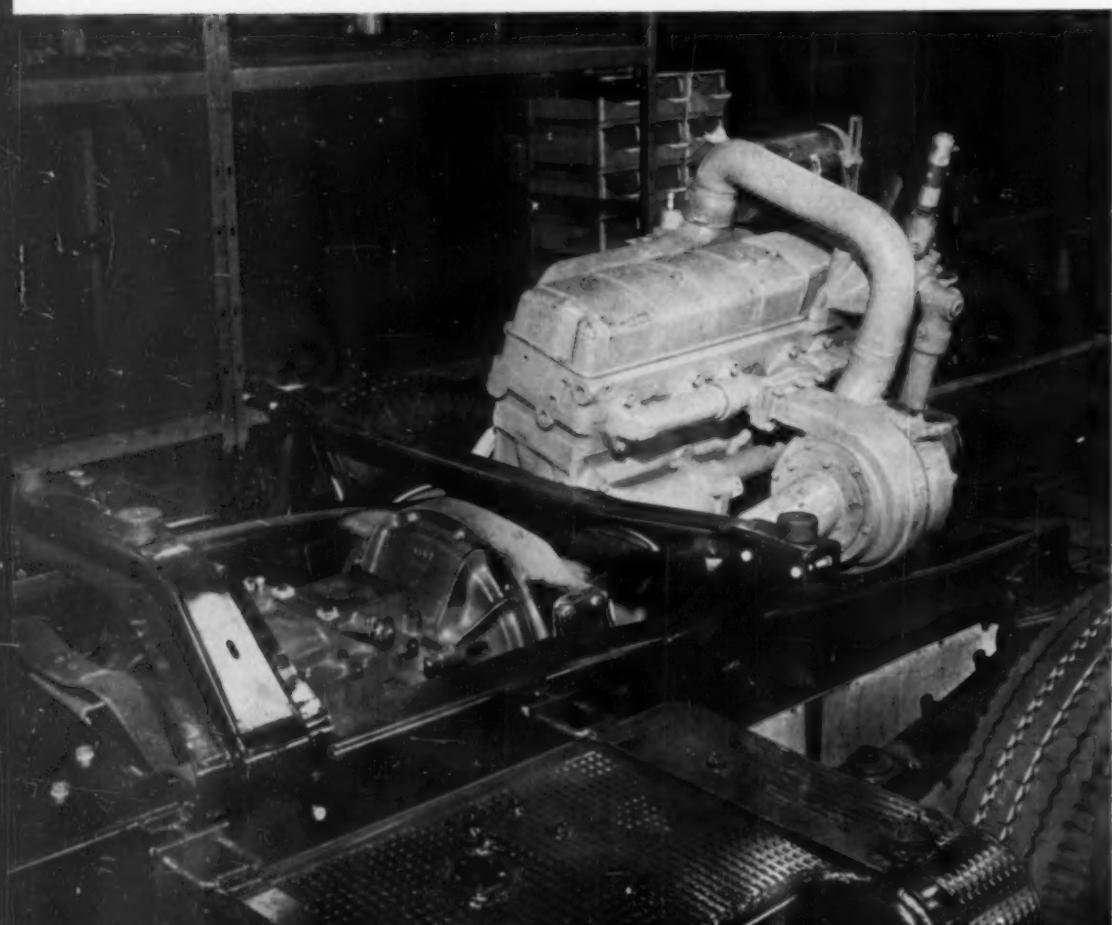
has solved our problems of operation in stop and go service under cold weather conditions and our figures show a 20 per cent reduction in fuel costs."

I had a chance to ride the *Neebish Islander* on several trips and was impressed with her performance. The trip used to take four minutes and, as has been mentioned previously, takes only three minutes now. Maneuverability is greatly improved and this is important as the ferry has to make a pretty tricky turn into the loading dock on the mainland against a swift current. This ferry also was required to obtain Coast Guard approval before the air cooled diesel could be installed and this has been granted.



Dodge NCT-1000 cab forward. Fenders swing forward, hood up permitting easy access to Cummins NH-220 engine. Lube oil filter at right is Luber-finer and dry-type air cleaner at left is Fram.

The Cummins C-175 turbocharged diesel installed in Dodge truck chassis moving down assembly line. Note 20 degree tilt of engine mounting and 3-point cab mounting pads. Note Leece-Neville generator, Fuller R-46 transmission and Rockford clutch.



NEW CUMMINS C-175 DIESEL USED IN 1960 DODGE LINE

**Engine Builder Introduces
Two Smaller Diesels for
Short Haul Service and
Medium Duty Trucking and
Construction Applications**

TWO new diesels, designed to capture more of the "stop and go" business plus medium duty trucking and construction equipment applications for the company, have been announced by Cummins Engine Co. Both engines, the C-160 and C-175, are lightweight, four-cycle, six-cylinder diesels with a $4\frac{7}{8}$ in. bore, 5 in. stroke, and piston displacement of 464 cu. in. The naturally aspirated C-160 is rated 160 hp at 2500 rpm. Its net weight with standard accessories is 1,555 lbs., equal to 9.7 lbs./hp. The C-175 is the turbocharged version and develops 175 hp, also at 2500. Its weight/horsepower is approximately the same at the C-160. It is one of four Cummins diesels selected for the 1960 Dodge truck line.

Mr. C. R. Boll, vice-president of sales at Cummins, stated that the C-160 should prove to be a very economical engine for use in such applications as "feeder line" hauling, tanker units, dump truck operations and other "stop and go" vehicles. Fuel curves for the C-160 point to good economy at idling and when lightly loaded, important factors in city and suburban traffic. In off-highway applications for the 160 hp unit Cummins is pointing to graders, shovels, loaders, rubber tired farm tractors, scrapers and similar applications. The slightly higher horsepower C-175, Cummins' officials believe will meet the particular requirements of main line truckers in the South and East and short haul operations throughout the country.

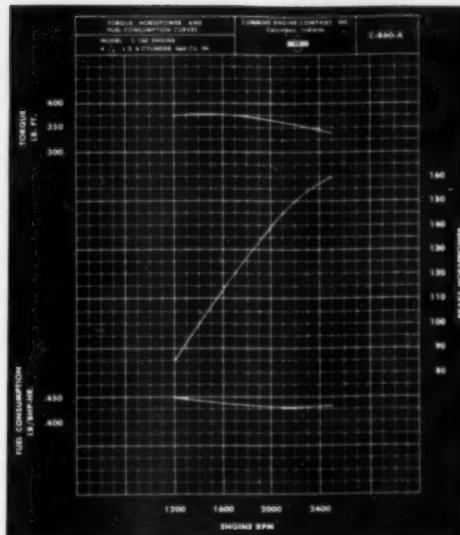
Both the C-160 and C-175 feature wet-type cylinder liners, the Cummins PT fuel system, open type combustion chamber and two intake and two exhaust valves per cylinder. Pistons are cam ground aluminum with four rings (3 compression and 1 oil). The crankshaft, with seven main bearings, is $3\frac{1}{8}$ in. in diameter. The flywheel is machined to accommodate a 14 in. Lipe-Rollway clutch and to

fit an S.A.E. No. 2 housing. Both engines are approximately 47 ins. in length, fan to flywheel. Twelve volt electrical system is standard and all automotive models are equipped with the Cummins 12 cfm. air compressor.

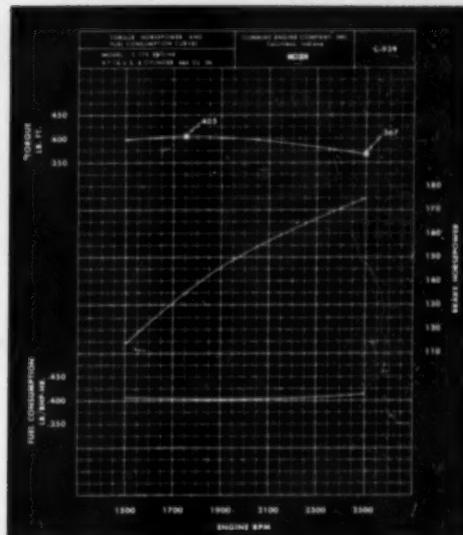
The announcement of the new Cummins powered Dodge trucks for 1960 was made early in October by M. C. Patterson, Dodge general manager. The new line includes conventional, cab-forward, 4-wheel drive, forward control, school bus chassis, and tandem units. Available are 15 different power options, four of which are diesel—the new Cummins C-175; the NH-180 with 180 hp, 672 cu. in. displ., and 504 lb. ft. torque; the NH-195 with 195 hp, 672 cu. in. displ., and 533 lb. ft. torque; and the NH-220 with 220 hp, 743 cu. in. displ., and 605 lb. ft. torque. All of the NH Cummins engines are naturally aspirated.

Several heavy-duty transmissions are offered on the Cummins diesels, the Clark five-speed 301 V and 308 V; the Spicer five-speed 6352 B and 6852 G; and the Fuller eight-speed R-46 and the ten-speed R-96. Auxiliary transmissions are Spicer three and four-speed. The C-175 engine takes a Rockford 15 in. single plate clutch and the three NH series diesels take Spicer 14 in. two-plate clutches. Front axles are Timken and rear axles are Timken or Eaton. Standard lube filters are Nugent full flow with Luber-finer by-pass optional. Vortox oil bath air cleaners are standard with Fram optional. In order to lengthen engine life in heavy-duty service an oil cooler is standard on the C-175 and NH-220 diesels. It is also available on the NH-180 and NH-195.

In an interview Patterson stated, "Dodge is the first of the 'low-price three' to enter the diesel picture. With our new styling and design, Servi-Swing fenders, increased gross vehicle weights up to 53,000 lbs., and increased gross combination weights up to 76,800 lbs. we will reach an important segment of the high-tonnage market previously unavailable to us." The Servi-Swing fenders



Performance curve of C-160

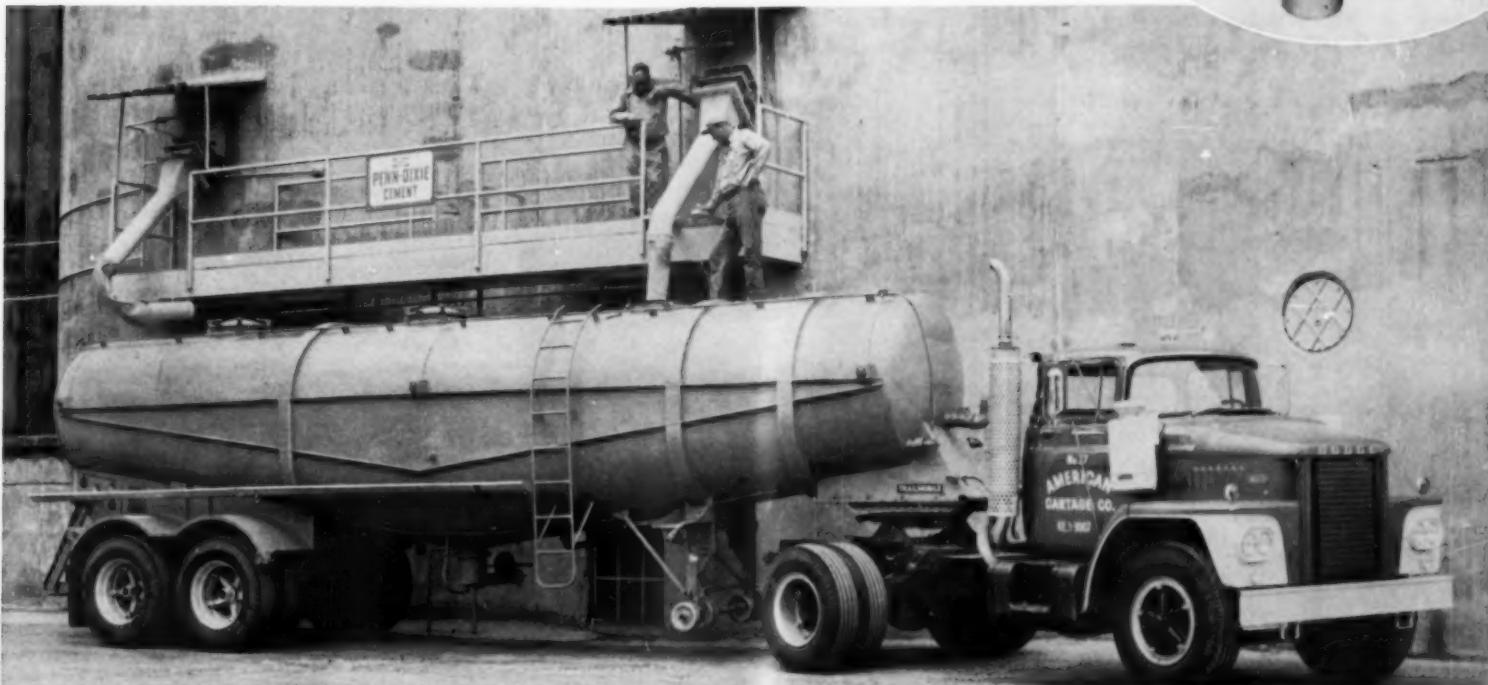
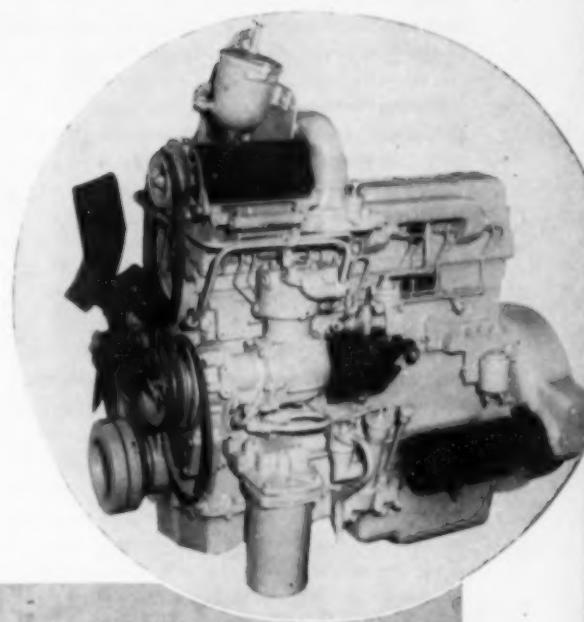


Performance curve of C-175

are one of the most impressive engineering and design features of the new Dodge truck "P" series. The front fenders on the new cab-forward models swing out 110 degrees at the release of a single latch to provide instantaneous access to the engine and its accessories. In addition, an alligator-type hood opens a full 90 degrees vertically, insuring easy access for servicing many components in the engine compartment. Automatic radiator shutters, which assure quick warm-up and economical operating temperatures, are standard on all diesel models of the new Dodge line.

View of the Cummins C-160 rated 160 hp at 2500 rpm. Net weight with standard accessories is 1,555 lbs. Automotive models are equipped with Cummins 12 cfm air compressor.

Powered by new C-175 diesel, this 1960 Dodge KC 800 tractor has maximum gross vehicle weight of 27,000 lbs. and maximum gross combination weight rating of 50,000 lbs. New Trailmobile trailer can carry up to 128 barrels of cement. Note Vortox air cleaner.





WHAT'S GOING ON IN ENGLAND

CONDUCTED BY BERNARD W. LANSDOWNE

Bernard W. Lansdowne is an associate member of the Institution of Mechanical Engineers and is widely known among British and European diesel manufacturers as a former editor of our English contemporary "Gas & Oil Power." His early workshop training was spread over seven years with A.E.C. Ltd., Southall, following which he served some five years with that company's sales engineering department. He is now manager-for-the-United Kingdom of a group of business and technical publications.

Mirrlees New Monarch Marine Diesels

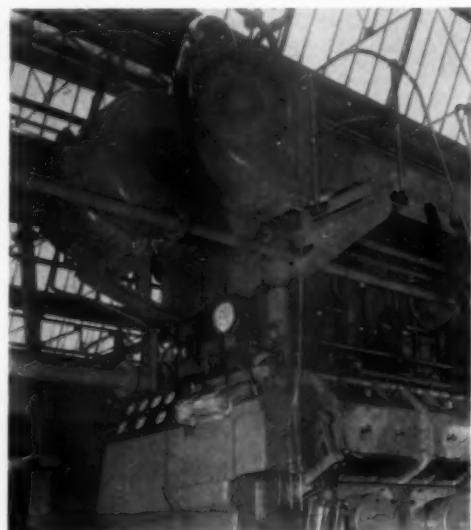
IN the comparatively short period of a decade since 1950, Mirrlees, Bickerton & Day Ltd., at Stockport, England, have introduced three ranges of large and impressive-performing diesel engines. These are their J series, the larger K range and their latest and largest Monarch design, announced in the past few months. Both the J and K series are commercially successful, but it was to meet the increasing demand for additional power in main propulsion for distant water trawlers, coasters, tugs and freighters that Mirrlees have produced the Monarch range. The new range is based on cylinder dimensions of 19 in. bore by 27 in. stroke and 6, 8, 10-cylinder turbocharged units will be available. These will give an overall power range of 1,600 to 4,300 bhp, at speeds from 200-300 rpm.

Before embarking on their design, Mirrlees took the unusual step in seeking the co-operation of the official representatives of the marine industry, including trawler owners and coaster owners, before finalizing the ultimate design. Their enterprise proved of great practical value in the preliminary planning stages and regular conferences were held at Mirrlees works from which emerged the final design. I saw the first Monarch unit on test at Stockport recently, this being a six-cylinder turbocharged direct reversing in-line unit rated at up

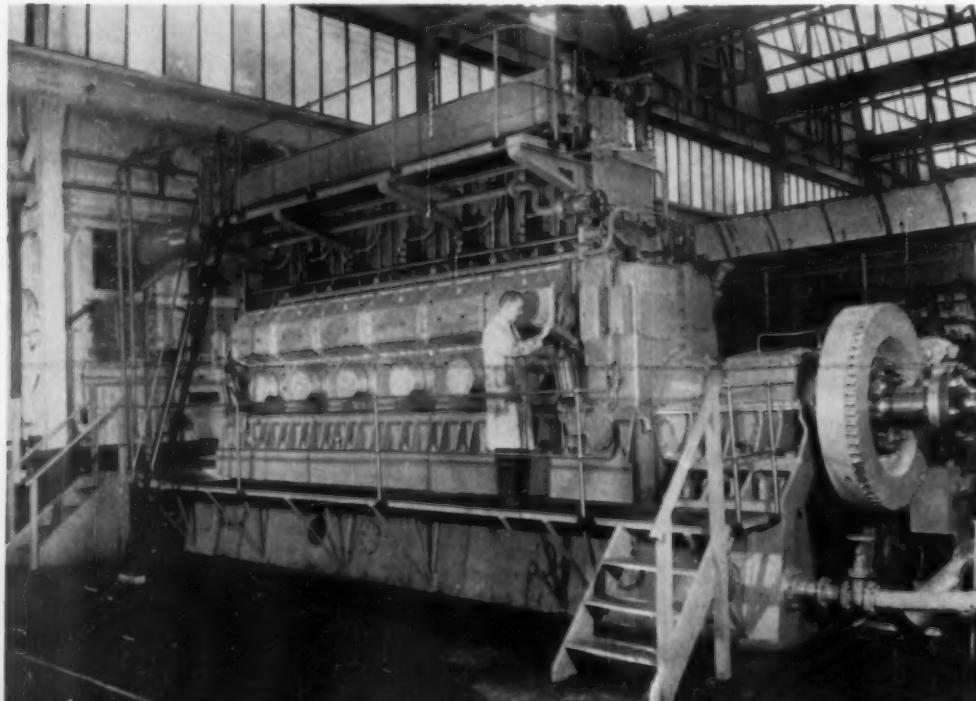
to 2,600 shp at 300 rpm with a Bmep of 150 lbs. per sq. in. I was particularly impressed with its reversing characteristics, the test bed time for this operation being approximately five to six seconds. The absence of propeller influence of course, must be taken into account, but there is no doubt that the inclusion of special decompression braking valves in each cylinder greatly improved the reversing time. These special valves are additional to the twin inlet and exhaust valves and are pneumatically operated to open every time the engine control is moved to the stop position. These valves cause the engine to come to rest by bleeding off the air on the compression stroke, thus allowing a large percentage of this compressed air energy to escape before the piston commences its downward stroke. Ahead and astern running is controlled by two sets of cams on the camshaft, one for each direction, while the reversing gear itself is arranged so that the ahead to astern, or vice versa maneuvering is carried out in one movement of the pneumatic reversing gear. Starting, reversing and speed selection is by hand levers grouped on the control station at the engine's forward end.

The governor is of the centrifugal hydraulic type manufactured by Woodward and it is positioned at the aft end of the engine. It maintains control

of the engine speed over the full running range. The framework of the six-cylinder engine I saw is built up from three one-piece castings, secured together by long through bolts passing from the top of the cylinder casing to the bedplate, these three castings consist of bedplate, column and cylinder casing. The bedplate carries the crankshaft, which is machined from a solid steel forging. The half coupling to which the flywheel is bolted is forged solid with the crankshaft and the whole is carried in white metal bearings of 15 in.



First Monarch diesel on test bed. Six-cylinder engine is rated 2600 shp at 300 rpm, 150 Bmep.



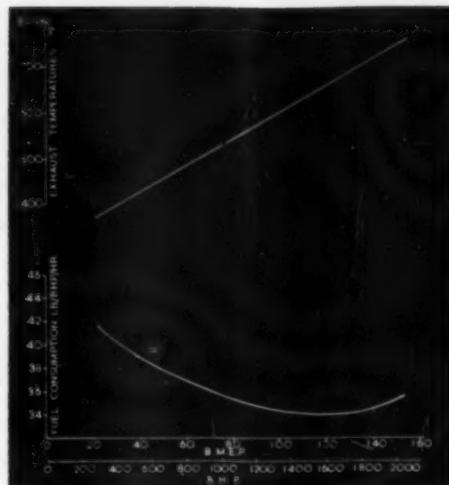
Turbocharger end of new Mirrlees Marine engine. Note Woodward governor and Bryce pumps.

diameter. The crankpin diameter is 14 in. which results in an overlap of crankpin with the journal and together with the substantial webs ensures an extremely rigid crankshaft.

The column forms the upper half of the crankcase and houses the camshaft. A feature here is that the camshaft can be removed athwartship which greatly facilitates maintenance on shipboard. Automatic spring loaded explosion doors with flame traps form part of each crankcase cover on the camshaft side of the engine. These are made by Pyropress Engineering Co. Ltd., to a design originated by the British Internal Combustion Engine Research Association (BICERA). The cylinder casing is mounted on the column and carries

the cylinder liners which are secured at the top and free to expand at the lower end. A feature of the cast iron cylinder heads are two air and two exhaust valves, all being in cages to facilitate easy maintenance. The fuel nozzle, cylinder relief valve and maximum pressure indicator cock are fitted in the head, in addition to the decompressor braking valve previously mentioned.

Individual fuel pumps of Bryce manufacture are mounted on top of the column above the engine camshaft and are operated by roller tappets. Fuel entering the engine is passed through two filters, which are both of the duplex type, the primary being of the metal element and the secondary of the fabric type. The pistons are oil cooled. Engine lubrication operates on the dry sump principle, with forced lubrication provided to all main, crankpin and camshaft bearings. One pump acts as a scavenge unit, which takes the oil from the bedplate and delivers it to the tank. The other pump feeds the engine pressure system, drawing



Performance curve for Mirrlees Monarch rated 1840 bhp at 230 rpm, 138 Bmep.

oil from the tank and passing it through the lubricating oil strainer and cooler to the engine. The pumps are cross-connected so that in any emergency the engine can operate as a wet sump unit using either pump. A closed circuit cooling system is recommended by Mirrlees for these engines, the system consisting of a primary fresh water and secondary sea water circuit, utilising a tubular heat exchanger.

The new Monarch engines have many qualities which suit them to multiple unit propulsion, particularly in view of their overall dimensions; the six cylinder engine is 23 ft. 9 in. long, 6 ft. 4 in. wide and 15 ft. high with an approximate weight of 72 tons. As a twin engine arrangement coupled to a twin input gearbox, two six-cylinder units will have an output of 5,000 shp at 300 rpm and an approximate all-up weight of 190 tons. The compactness of such an installation and the reduction in weight permit an increase in the freight carrying capacity of the vessel.

Simms Announces Its Minipump

IN the United Kingdom and Europe over the past few years, there has been a very marked trend towards the dieselization of lighter commercial vehicles, taxi cabs and small trucks. So much so that today, the major portion of British vehicles in these classes, now use diesels and show an impressive saving in operating costs over their petrol engined counterparts. Part of this saving results not only from immediate economy arising from lower fuel costs for diesel as opposed to petrol—a saving which is much greater in the United Kingdom than in America—but also from the greatly enhanced service operating period obtainable with diesel engines.

These small high speed diesel units installed in lightweight vehicles in England make use of conventional in-line fuel injection pumps or the distributor type pumps depending upon the application, etc. With the small modern engines, progressively less space is available for the injection pump and other auxiliary equipment installation. With this in mind, Simms Motor Units Ltd. set out to design a new, in-line pump, both compact and lightweight, that would retain the reliability and maintenance features of its established line. The outcome of this work is the introduction in London recently of the Simms Minipump.

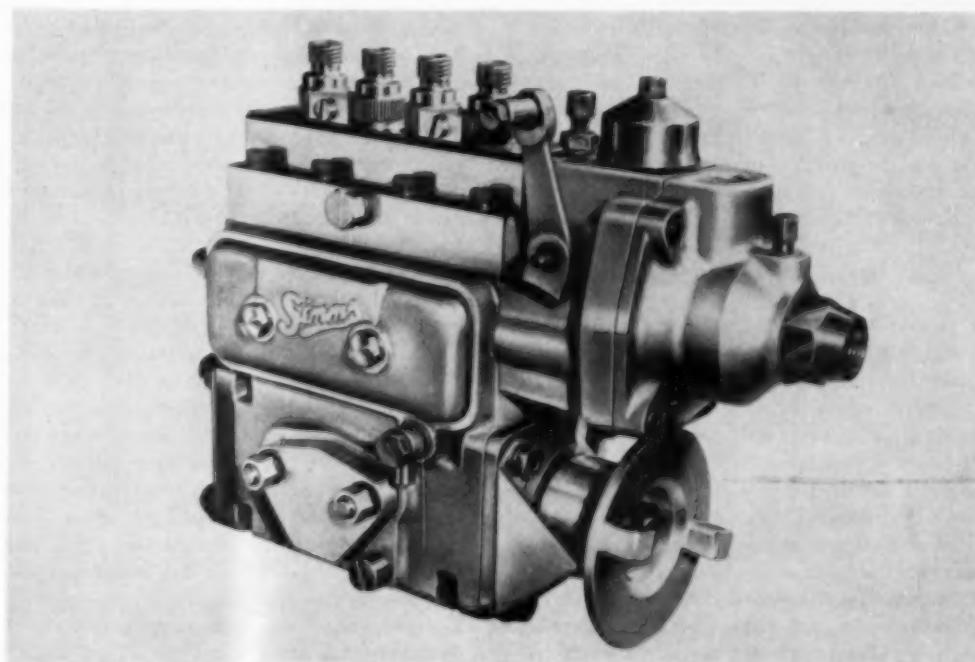
The Minipump range is suitable for engine designs of from two to six liters capacity and either pneumatic or centrifugal governors can be fitted, according to the installation requirements. An integral feed pump can be fitted to the cam box if required and an eccentric is machined on the camshaft for its operation. The Minipump may be flange mounted or platform mounted on the engine. Pump elements from 6.0 to 10.0 mm. diameter are available, the element barrels being of a special type, serrated on the locating diameter to match corresponding serrations in the pump body. The plungers are similar to those of the existing Simms 'A' size pump in which the fuel delivery is controlled by an inclined groove or helix. Rotation of the pump plungers to vary the fuel delivery is effected by a control rod of square section sliding

in bushes in the cam case. Control forks are clamped to the control rod and engage arms projecting from the lower ends of the plungers. The movement of the control rod therefore causes an angular movement of the plunger arm in an identical manner to that of the 'A' size pump. This method of fuel control reduces backlash. The control forks, at a greater radial distance from the plunger axis, give a fine and accurate calibration.

A maximum fuel stop and an excess fuel device are both built into the governor and are contained in the governor front-half casing on both the pneumatic and centrifugal types. The pump casing is divided horizontally into two halves, the upper half being of steel and containing the fuel passages and pump elements. The lower half forms the cam box containing the camshaft and tappets

and is of light alloy. The upper half can be removed for inspection of the elements, without disturbing the camshaft. The delivery valve holders are serrated on their outside diameter instead of being the more usual hexagon shape. The camshaft is of substantial dimensions, ensuring maximum rigidity and is fitted with similar bearings to those of the 'A' size pump. The success of Simms' designers in achieving a saving in space requirements was readily apparent when I compared a prototype Minipump with a conventional 'A' type unit at Simms' Finchley Works recently, and a saving in weight and cost has also been achieved. All-in-all it would seem that Simms have, in their Minipump, a design that can with confidence, take its place alongside their familiar 'A' type, of which nearly half a million have been produced in the last ten years.

New, compact four-cylinder Simms Minipump is well suited for small automotive and farm diesel applications.





DIESEL SERVICE PROGRESS

A COMMENTARY BY GEORGE R. MACKEY

George R. Mackey was long associated with Detroit Diesel Engine Division of General Motors Corp., and had prior experience as a mechanic in Europe and the U.S.A., which enabled him to become well acquainted in the diesel and service fields and to obtain a broad scope of the service industry from the customer's and management's viewpoint. Further training at Carnegie Tech and in the Army Ordnance during World War II provided the necessary requirements in planning service programs. Progressive advancement in diesel service areas in General Motors and with Detroit Diesel led to his position as Supervisor of Service Promotion. Upon termination of employment with General Motors in 1952, he joined Clayton Manufacturing Company, and his present position with this organization is Sales Manager of the Dynamometer Division.

Warranty and Policy

Warranty, policy, and other required procedures, set forth by manufacturers and management of a servicing organization, are sometimes misunderstood. Therefore, an understanding of the reasons for establishing such practices should be given to assure customer satisfaction in the operation of the products, safeguard the authorized servicing organization, and maintain customer good will. A careful study of warranty certificates, handling of warranty and policy matters, and other established practices, will show the manufacturer's interest to accomplish the desired results. It is understandable that these practices will vary with the types of products concerned; however, they all have the same purpose in mind—satisfactory performance of the product.

All warranty and policy matters are finalized only upon the presentation of a claim for such adjustment. The responsibility of initiating these claims belongs to the distributor/dealer Service Manager. Only by following each step of the manufacturer's procedure can such claims be analyzed and the proper settlement concluded. Types of claims established by manufacturers for which the servicing organization is responsible are warranty and policy. Each of these claims have been established after careful consideration to provide a definite purpose. Each must be handled on a different basis of reasoning set forth by the manufacturer, and must be processed in accordance with procedures designed to provide prompt, satisfactory settlement of the claim.

Warranty Adjustments

A general definition covering forms of warranty is that it is a written pledge between the manufacturer and customer relative to the correction of possible defects in material and workmanship within a specified period of time. Sometimes other permitted protections, benefits and allowances are included and described in detail within the certificate of warranty. The period of warranty is a specified time interval in which any malfunction, performance due to or caused by a defect in material or workmanship should normally occur. It can generally be assumed that any product, such as an engine or piece of powered equipment which per-

forms satisfactorily and delivers expected service beyond the specified warranty period, was assembled and shipped from the factory without defects in material and workmanship.

Manufacturer's warranty is not synonymous with hazard guarantee, special service policies, or other types of performance insurance. Such additional guarantees and insurance policies are generally separate business transactions between the purchaser and the selling organization which provides additional protection over and beyond the standard warranty. Some selling organizations offer these additional forms of insurance for an additional charge which may, or may not be included in the total purchase price of a product. Such policies are separate contracts whereby the purchaser can buy stipulated service or maintenance over and above that normally covered in the manufacturer's warranty. Sometimes these policies include parts and labor, but often such agreements only include labor for specified services. In effect, these agreements may be looked up as methods for a customer to purchase required services; however, such agreements are primarily offered for the customer's protection. Policies and maintenance agreements purchased from authorized service organizations are generally considered a good investment, especially for the smaller operations who are unable to provide adequate service or perform the required maintenance. In addition, such contracts can influence new owners on the use of authorized service facilities.

Defective parts can be defined as parts which fail because of a weakness unknown at the time of assembly. A typical example of this would be a sand hole in a casting. Defective workmanship can be defined as the incorrect machining of a part or the incorrect assembly of parts. Examples of this are off standard size bearings, stripped threads, and mis-matched parts. The proper interpretation of a manufacturer's warranty certificate and the correct application of its statements of intent can be a guide to the servicing organization. Great care must be exercised to be sure that interpretation of the warranty obligation is correct and that there is no misunderstanding. Such oversights can lead to possible legal action.

Many manufacturers have established procedures whereby authorized servicing organizations are obligated to perform specific services on products during warranty period. Such services often include installation and performance inspection, field adjustments, maintenance checks, and operator training. The completion of these obligated services provide many definite advantages, such as eliminating many warranty adjustments, reducing customer complaints, and eliminating factory intervention on behalf of the customer. They also provide the servicing organization with an excellent opportunity to sell the customer on quality service, build good will, and increase the new owner's satisfaction in his purchase.

There should be no hesitancy on the part of the servicing outlet in determining facts relative to product performance and, when necessary, initiate positive action within the warranty period to properly administer the terms of the manufacturer's warranty. However, since misuse and negligence may be a contributing factor to a warranty claim, good judgment must be applied as warranty is not an automatic adjustment based upon the customer's request. A manufacturer's warranty, properly applied, provides two necessary functions for the future growth of his entire organization—the building of good will and applying pertinent facts for the improvement of his products.

Policy Adjustments

Manufacturers do make adjustments beyond the time limit specified in the published warranty as an accommodation to both the customer and servicing organization. Such transactions are classified as policy adjustments. A simple definition which will differentiate between warranty and policy is:—policy takes over when warranty ends. While warranty is a definite obligation for a specified period of time, there is no fixed basis for pre-determining when and to what extent policy adjustments can be made. Each claim for policy adjustment must be considered on an individual basis. A common misunderstanding in the service business relative to the difference between warranty and policy is that warranty is fixed while policy is variable. The basic reasoning behind all policy adjustments

is to allow both the distributing organization and the manufacturer to extend their service obligations and provide a means to avoid customer antagonism when difficulty is experienced beyond the time limits specified in the published warranty. This type of adjustment is a special concession which manufacturers may elect to make over and above all warranty obligations. They reserve the right to use this form of adjustment with discretion based on the individual merits of each case. Pertaining to warranty, the manufacturer has no alternative but to accept the claim providing it is within its specifications. For claims beyond this point, the final decision rests with the manufacturer and the servicing organization.

Efficient Claim Handling

Time is a very important factor in handling both warranty and policy claims. From the moment a customer brings his problem to the attention of the Service Department, action is important. Excuses, mishandling and unnecessary delay, may tend to aggravate the customer's attitude and may result in additional difficulties encountered to obtain his complete satisfaction. Furthermore, it will defeat the purpose of warranty and policy adjustments. Delay in completing necessary forms, deviation from established procedures, and failure to follow shipping instructions for parts to be returned to the factory may further delay the settlement of a claim. These conditions, while contributing to the dissatisfaction of an owner, can also affect the servicing organization's attitude against policy matters, with a resulting lack of interest in the efficient handling of future claims. In the settlement of all claims, there must be a balance of fairness between the factory, servicing organization and the customer. An attitude of too strict adherence to the details of a policy may not fulfill the desired objectives. However, a complacent attitude is also undesirable. Only by applying sound judgment can the end objectives be reached to the complete satisfaction of all.

Named Engineering Director For Fairbanks-Morse



Walther C. Fischer

Walther C. Fischer, award-winning engineer who recently completed a penetrating survey of industry in Europe for Fairbanks, Morse & Co., has been appointed the firm's director of engineering, it was announced by Robert W. Kerr, President. Kerr said the appointment was a

major step in the internal reorganization of the company's operations. Fischer, a career man at Fairbanks-Morse since 1935, took over his new post on October 1, with headquarters in Chicago. The new director of engineering is advancing from his position as manager of engineering of the Beloit Works of Fairbanks, Morse & Co., in Beloit, Wis. In Chicago he is succeeding Gordon R. Anderson, who has been appointed vice president and general manager of the Beloit Division of Fairbanks-Morse. Fischer was awarded the distinguished serv-

ice citation by the University of Wisconsin on May 1, 1959, in recognition of his professional services in engineering. Well known in the profession and throughout industry, he is an active member of the American Society of Mechanical Engineers. During his recent trip abroad, he made a survey of European industries manufacturing goods complementary to the production line of Fairbanks, Morse & Co. Fairbanks-Morse has completed licensing arrangements for the production here of a European compressor. During the past 24 years with Fairbanks-Morse, Fischer has held the posts of application engineer, assistant director of engineering in Chicago, and assistant manager of engineering. He was appointed manager of engineering at Beloit in 1951. Fischer was gradu-

ated from the Swiss Federal Institute of Technology, Zurich, Switzerland, in 1929. He served with Brown, Boveri & Cie., Baden, Switzerland, manufacturers of generators and heavy industrial equipment, until 1932. From 1932 to 1935 he was associated with the Swiss Federal Institute of Technology.

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AP935



DIESEL ECONOMY FOR MILK DELIVERY

By ED DENNIS

NOT long ago "Old Dobbins" supplied all the horsepower necessary for the nation's milk delivery wagons. Today, all the horses needed for one of the delivery trucks owned by McArthur Dairy, Miami, Fla., is being supplied by a model OM 321 Mercedes-Benz diesel engine. On its first three regular trips to West Palm Beach (120 miles round trip), the 96 hp diesel engine performed up to expectations. The newly dieselized model NL-160 International truck averaged, with a load, 11 mpg of fuel oil with a maximum governed speed of 40 mph for the first 360 miles.

The OM 321, a 6 cylinder vertical in-line, 4 cycle, liquid cooled, naturally aspirated diesel, is rated 96 hp at 2600 rpm. It has a bore and stroke of $\frac{3}{4}$ by $4\frac{1}{4}$ in. Piston displacement is 511.2 cu. in., with a compression ratio of 19.5:1. The pistons are of aluminum alloy with six rings; the cylinder block is chrome-nickel alloy cast iron. Installation also included a Clark 5 speed transmission, along with a Lipe-Rollway 11 in. clutch in place of the 10 in. clutch. The differential (rear axle) is the same and the ratio is 6.6:1 with a single axle and dual wheels with 8.25 x 20 tires.

Installation of the OM 321 was a simple job with only a few changes in the engine mounting. The

This model NL-160 International milk delivery truck owned by McArthur Dairy, Miami, Fla., recently was re-powered with a Mercedes-Benz OM 321 diesel.

job was handled by master mechanic Loyal Head and one helper. The installation was engineered and supervised by Mr. John Roehr, Curtiss-Wright Corp. engineer. Diesel engines are not new to the McArthur Dairy, which was founded in 1929. The firm maintains several standby generators in the plant and out on the farm. It operates about 350 trucks from four garages. According to Mr. R. E.

Breedlove, maintenance superintendent at the main garage, all of the McArthur trucks and equipment are constantly checked. A regular preventive maintenance program is followed. The new truck, which hauls 200 cases of milk, each weighing 60 lbs., averaged 3 to 8 mpg with its old 120 hp gasoline engine. The new Mercedes-Benz diesel is averaging 11 mpg.

Closeup of the OM 321, which has Robert Bosch injection system and a Bosch 12 volt generating and starting system. Engine develops 96 hp at 2600 rpm.



80-TON COAL HAULER HAS 450 HP V-12

AN 80-ton bottom dump coal hauler, claimed to be the largest commercially built coal hauler in the world, recently was announced by LeTourneau-Westinghouse Co., Peoria, Ill. A member of the LW Haulpak truck line, the unit was developed for use in coal strip mining operations where large capacity haulers make extraction more economical. The unit has a capacity of 100 cubic yards. Powered by a Cummins V-12, 450 hp engine, the Haulpak operates at speeds up to 40 mph. It has an Allison torque converter and transmission with four speeds forward, two reverse. An automatic lock-up in the three highest forward speeds is incorporated.

The unit departs from conventional design. The 80-ton capacity is attainable, LW says, because of extremely compact overall dimensions and very low center of gravity as a result of special body design. The coal hauler has no springs. Four big



LeTourneau-Westinghouse's 80-ton bottom dump coal hauler was developed for use in coal mining operations. It is powered by a 450 hp Cummins diesel.

pistons are used instead. Conventional axles have been eliminated. "Hydrair" suspension pistons are used at the rear axle of the trailer, on the rear wheels of tractor and on individually suspended front wheels. An identical "Hydrair" unit is used as a part of the kingpin structure.

Box beam construction and corrugated side sheets are utilized in the dump trailing unit. Design of the doors at the bottom of the trailing unit enables discharge of the load four inches from the ground.

Overall dimensions of the Model 80 are: length, 55 ft. 9 in.; width, 12 ft.; height, 12 ft. It has an overall wheelbase of 43 ft. 6 in.

The Haulpak line, marking LeTourneau-Westinghouse's entry into the truck field, has three models. In addition to the 80-ton unit, other units are a 27-ton end dump truck and a 32-ton end dump truck. The 27-ton dump is equipped with a Cummins NRTO-6-BI, 335 hp diesel; the 32-ton unit has a Cummins NFT-6-BI, 375 hp engine.

FIAT'S 2650 HP PER CYLINDER

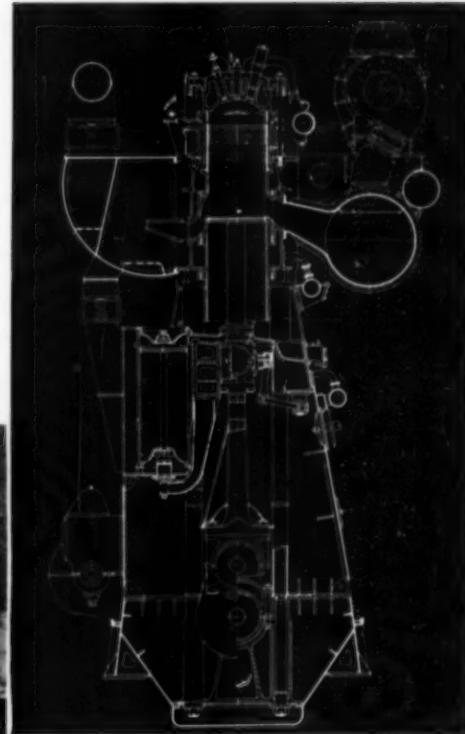
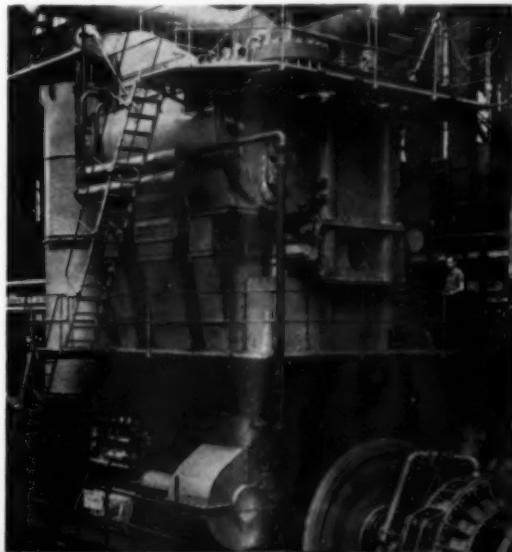
AN order for a 9-cylinder engine with 35.43 in. bore and 62.99 in. stroke to power a 38,000-ton tanker has been placed with Fiat Grandi Motori, Turin, Italy, by shipowner Achille Lauro. The tanker is under construction in Italy. To speed construction of the engine, Fiat built a 2-cylinder experimental unit and started tests on it in mid-June 1959. A test output of 2650 bhp per cylinder was reached, Fiat claims. Design of the engine for the tanker is similar to others of the Fiat line, particularly of the type 750 (29.53 in. bore and 51.97 in. stroke). Features of the engine for the new tanker include:

- Thrust bearing is incorporated in the crankcase.
- Welded crankcase and frame structure.
- Steel through-bolts connect the crankcase with the top end of the main cylinder.
- Special arrangement of ports to improve scavenging.
- Use of cross scavenging.
- Use of two-part engine liner, with top part in steel.
- Efficiently cooled, thin-walled main heads.
- Simple main cylinder head has one atomizer, starting valve and safety valve.
- No shaft for distribution gear drive. Fuel pumps are arranged at the bottom near the crankcase and are driven by three small-gear wheels.
- Turbochargers arranged in series, with cross-

head driven reciprocating air pumps. Turbochargers are constant-pressure fed.

The test result of 2650 bhp at about 127 rpm corresponds to 29.3 lbs./sq. cm. bmeep. Fuel consumption with a medium-grade fuel at a speed corresponding to about 2000 bhp per cylinder was about .34 lb./bhp hr. Fiat says that the engine can be operated on heavy fuels.

Fiat 902S 2-cylinder experimental engine on test bed.



Cross section of 902S.

American Bosch Acquires Ensign Carburetor Company

American Bosch Arma Corp. has acquired all of the outstanding stock of Ensign Carburetor Co., manufacturers of carburetors for stationary engines burning natural gas, and carburetion systems used on engines burning liquefied petroleum gas. Ensign will be operated as a wholly-owned subsidiary. Appointed division manager of Ensign is Norton C. Sather, former manager of American Bosch's west coast office. Mr. A. J. St. George, formerly sales manager at Ensign, has been appointed staff assistant to Bert Cole, ABA general sales manager. In this position St. George will continue to direct his efforts in sales and promotion of Ensign products from the Fullerton, Calif. factory.

The acquisition by American Bosch broadens the company's commercial product line since Ensign products complement the fuel injection equipment produced in Springfield. Mr. Sather brings to his new position a wide range of experience. He has served ABA in various positions, including manager of the contracts department of the Chicago Division and manager of the Air Force contracts administration. He was previously with Hall-Scott Motors Division of ACF-Brill Motors at Berkeley, Calif., as assistant vice president of government contracts and sales. Earlier he operated his own business interests in Los Angeles which included machine shop and casting operations. He also has 18 years background in aircraft manufacturing operations. Mr. W. W. Harris succeeds Mr. Sather as manager of the west coast office.

New Color Selected for Starting Fluid Can

Spray Products Corp., Camden, N.J., has announced that Spray starting fluid for diesel and gasoline engines is now being marketed in a newly designed pressurized white container with orange



lettering. The starting fluid, which was formerly dispensed in orange colored cans, can be sprayed down to 65 degrees below zero, according to the manufacturer. The product was introduced in pressurized cans in 1956.

Electric Machinery Officers

In our September issue, captions beneath photos of two officers of Electric Machinery Mfg. Co., were reversed. Mr. Arthur P. Burris, who was elected the company president and general man-



Arthur P. Burris



C. E. Buchan

ager, was incorrectly identified as Mr. C. E. Buchan, who is the firm's new sales vice-president. Here are the two gentlemen, correctly identified.

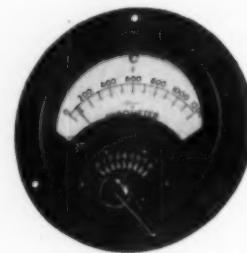
Distributor of Daros Rings Opens New Warehouse

Piston Products, American distributor of Daros Swedish piston rings and cylinder liners have moved to their new and larger warehouse facilities at 7324 N. Lawndale Ave., Skokie, Ill. (a Chicago suburb). Large warehouse stocks of Daros piston rings for all types of diesel engines will be maintained at this point for prompt shipment to all points in the U.S. The Daros line includes compression and oil control rings as well as cylinder liners. The company's sales engineering department will also be located in the same building, offering engineering consultation to all diesel manufacturers and users on Daros rings and cylinder liners.

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with**



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**...on diesel or gas engine
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There's an Alnor Pyrometer and thermocouple assembly for every installation. Send for Bulletin 4361. Illinois Testing Laboratories, Inc., Room 308, 420 N. LaSalle St., Chicago 10, Ill.



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T

To the Employee Relations Director

of every American company

LET'S FACE IT . . . the threat of war and the atom bomb has become a real part of our life—and will be with us for years. Fires, tornadoes and other disasters, too, may strike without warning.

The very lives of your employees are at stake. Yours is a grave responsibility. Consider what may happen.

When the emergency comes, everybody's going to need help at the same time. It may be hours before outside aid reaches you. The best chance of survival for your workers—and the fastest way to get back into production—is to know what to do and be ready to do it. To be unprepared is to gamble with human lives. Disaster may happen TOMORROW. Insist that these simple precautions are taken TODAY:

Call your local Civil Defense Director. He'll help you set up a plan for your offices and plant—a plan that's safer, because it's entirely integrated

with community Civil Defense action.

Check contents and locations of first-aid kits. Be sure they're adequate and up to date. Here again, your CD Director can help—with advice on supplies needed for injuries due to blast, radiation, etc.

Encourage personnel to attend Red Cross First Aid Training Courses.

Encourage your staff and your community to have their homes prepared. Run ads in your plant paper, in local newspapers, over TV and radio, on bulletin boards. Your CD Director can show you ads that you can sponsor locally. Set the standard of preparedness in your plant city. There's no better way of building prestige and good employee relations—and no greater way of helping America.

Act now . . . check off these four simple points . . . before it's too late.



SPACE FOR THIS

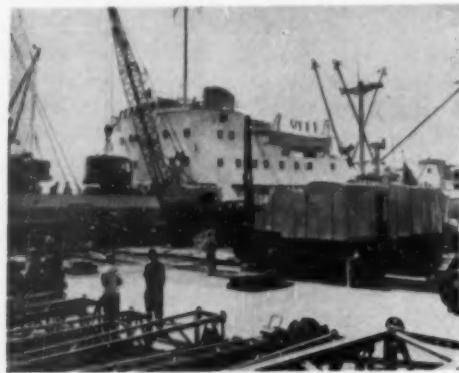
CIVIL DEFENSE

MESSAGE CONTRIBUTED BY



10 Excavators Shipped To Iraq Via Seaway

It's "bon voyage" for 10 diesel driven Bucyrus-Erie 22-B excavators—eight hoes and two draglines—as they are loaded aboard the cargo ship SS *Borealis* at Erie, Pa., for the long trip to a pipeline project in Iraq. The $\frac{1}{4}$ cu. yd. excavators, built at Bucyrus-Erie's Erie works, traveled to Iraq via the St. Lawrence Seaway—the first direct ship-



ment between Erie and the Middle East. Equipped with high-walking tractor-type crawlers, the 10 machines and accessory equipment weighed a total of 276 tons. All 10 are equipped with 6 cylinder Caterpillar D318 engines, which have a continuous rating of 90 hp at 1800 rpm. The machines were purchased by Turriff-Burden, Ltd., a joint venture of Turriff Construction Corp. Ltd., Warwick, England, and O. R. Burden Construction Co., Tulsa,

Oklahoma. They will be used on two sections (totaling 340 miles) of the Kirkuk-Basra pipeline project for Iraq Petroleum Co. Ltd.

Fairbanks, Morse & Co., Names Beloit Division Head



G. K. Anderson

Gordon R. Anderson has been named vice-president and general manager of the Beloit division of Fairbanks, Morse & Co., according to an announcement by Robert W. Kerr, president of the Chicago headquartered industrial firm. Mr. Anderson, a graduate of the Electrical

Engineering School of the University of Michigan, joined Fairbanks-Morse in 1922 at their Indianapolis plant, transferring to Beloit Works in 1929. Appointed chief electrical engineer in 1932, he successively became manager of engineering at Beloit, general manager of Freeport Works, general manager of Electrical Division, general manager of Kansas City plant, chief engineer of the Company, and most recently, vice president—engineering with offices at company headquarters in Chicago. As vice president & general manager of the Beloit Division, Anderson will have complete responsibility for the Beloit operation. This will include production and sales of diesel engines, locomotives, compressors, magnetos and rewind starters.

Twin Disc Promotions



E. B. Falk



Robert Smith

Twin Disc Clutch Company, Racine, Wis., has announced two promotions: that of E. B. Falk to director of advertising and public relations, and that of Robert Smith to public relations manager. Mr. Falk has handled a wide variety of assignments in the engineering, advertising and sales departments since joining Twin Disc in 1946. Prior to his new promotion he was manager of advertising and sales promotion. He is a graduate of Marquette University with a B.S. Degree in mechanical engineering. While serving in the Navy during WWII, he attended M.I.T. where he received a certificate in aeronautical engineering. Mr. Falk is a member of S. A. E. and a commander in the Naval Reserve. Mr. Smith rejoined Twin Disc recently after serving for 4 years as public relations director of the national organization, Mutation Mink Breeders Association. He is a graduate of Lawrence College and served as a major in the U. S. Army during WWII.

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Worthington Makes Changes In Buffalo Division

Worthington Corporation announces a major organizational change at its Buffalo, N.Y., compressor and engine division. Effective September 1, the former Engine Sales Department became two separate groups: Power Engine Sales and Engine Compressor Sales, both reporting to E. A. Murray, manager of sales & service. Alfred M. Boehm was appointed manager of power engine sales and Howard C. Barten became manager of engine compressor sales. The reorganization took place following the retirement of Willard E. Wechter, former manager of engine sales department, who left the company for reasons of health after 36 years of service. Mr. Boehm, a graduate of the



Howard C. Barten



A. M. Boehm

University of Notre Dame with a degree in mechanical engineering, joined Worthington Corporation as a test engineer in the Buffalo division in 1924. He later transferred to engine sales. After several years in Kansas City and Chicago as engine specialist, he was loaned to People's Gas Light and Coke Company of Chicago, with whom he served for 7 years as supervisor of gas sales for internal combustion engines. He was recalled by Worthington in 1944 and became manager of the eastern engine division, located in New York City, in 1950. Mr. Barten received his degree in mechanical engineering from the University of Detroit. He joined Worthington in 1934 as a test engineer. Subsequent assignments included engine sales in Buffalo and engine specialist work in New York, Cleveland and Cincinnati. He returned to engine sales, Buffalo, in 1942. Since 1955 he has been manager of the gas transmission section of the engine sales department.

Diamond Chain Promotes Three With Cooper Named Sales Manager



J. E. Cooper

Jack E. Cooper has been named manager of sales for Diamond Chain Co., Indianapolis subsidiary of American Steel Foundries, Inc. Cooper succeeds A. S. Basten who has announced his retirement after over forty years of service to the chain industry. Cooper, formerly assistant to the

sales manager, previously served in Diamond's Chicago and Atlanta offices for several years. D. G. Viskniskki, formerly manager of the company's Chicago offices, has been promoted to assistant manager of sales in the Indianapolis office. H. B. Biersdorfer, formerly district manager of the company's Cleveland office, has been promoted to manager of market research in the Indianapolis office.

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FIXED BUNDLE

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- Rolled tube joints . . . industry accepted standard of quality construction.
- Single and Multiple Pass Designs . . . available in 2" through 10" diameters.
- Now available from stock.
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Over 75 years of service to industry

HEAT TRANSFER DIVISION



Yates-American

MACHINE COMPANY
703 4th St. BELOIT, WISCONSIN

Michigan-Ohio News

By Jim Brown

THE APPOINTMENT of R. J. (Rick) Reynolds to the sales staff of Wolverine Tractor & Equipment Co. of Detroit & Grand Rapids has been announced by T. F. McNutt, president. Mr. Reynolds will work out of Lansing and will repre-

sent Wolverine for the following counties: Clinton, Shiawassee, Eaton, Ingham, Livingston and Jackson.

CYRIL J. Burke, Inc. of Detroit reports the sale of a Pettibone model 401A grader. The new grader has a 12 ft. blade, is powered by a Hercules model 358 diesel engine and was purchased by Carlton Paving Co. of Saginaw, Mich.

A MODEL 305 Koehring standard combination dragline, clamshell and lift crane equipped with a GM diesel model 3-71 engine was recently sold to Wyatt Excavating Co. of Three Rivers, Mich.

MICHIGAN Tractor & Machinery Co. of Detroit reports the installation of a new generator set on Beaver Island. The power plant is the third such unit installed on Beaver Island by Michigan Tractor & Machinery. This unit was a Caterpillar model 375 engine in a 150 kw generator set.

highway construction project on M-65 near Oscoda County. The new unit is powered by a Cummins JT-6-I diesel engine and was purchased from Miller Equipment Co. of Livonia, Mich.

THE Cummins Engine Co., Inc. has donated a 60 kw model HRC-4-G standby generator set to the Fostoria, Ohio City Hospital. The switch-gear is to be supplied by Cummins Diesel Michigan, Inc. of Dearborn, Mich. who will also supervise the installation.

GRAND Traverse County Road Commission of Traverse City, Mich. has accepted delivery on a new International TD-20 crawler equipped with a cable bulldozer and front-mounted winch. Sale was made by Wolverine Tractor & Equipment Co. of Detroit and Grand Rapids.

VERMEERSCH Construction Co. of Lansing, Mich. breaking in a new Allis-Chalmers model HD11E crawler equipped with an 11BD hydraulic 'dozer and a model 261 cable control unit. The new crawler was sold by Earle Equipment Co. of Detroit.

A 1 1/4 YD. Northwest model 6 Pullshovel equipped with a Murphy diesel engine was recently sold by Cyril J. Burke, Inc. of Detroit. The new Northwest is being used on subdivision work in Northeast Detroit by the Advance Construction Co. of Detroit.

PIERSON Contracting Co. of Saginaw has purchased a Michigan model 280 Tractor-dozer to use on a highway construction project (US-12) near Jackson, Mich. The new dozer is powered by a Cummins model NTO-6-BI diesel engine and was purchased from Miller Equipment Co. of Livonia, Mich.

E. & L. Transport Co. (auto-haulers for Ford Motor Co.) of Dearborn, Mich. are installing two Cummins diesels in their fleet of 250 tractors on a test basis. One will be a model JT-6-B (175 hp) which will be installed in a Ford F-800 tractor, to be used in hauling farm tractors. The other one is a model C-160-B installed in a Ford F-700, to be used for a "4-car" automobile haul. Transmissions in both are Spicer (models 6453A) with 15 in. single plate Lipe clutches.

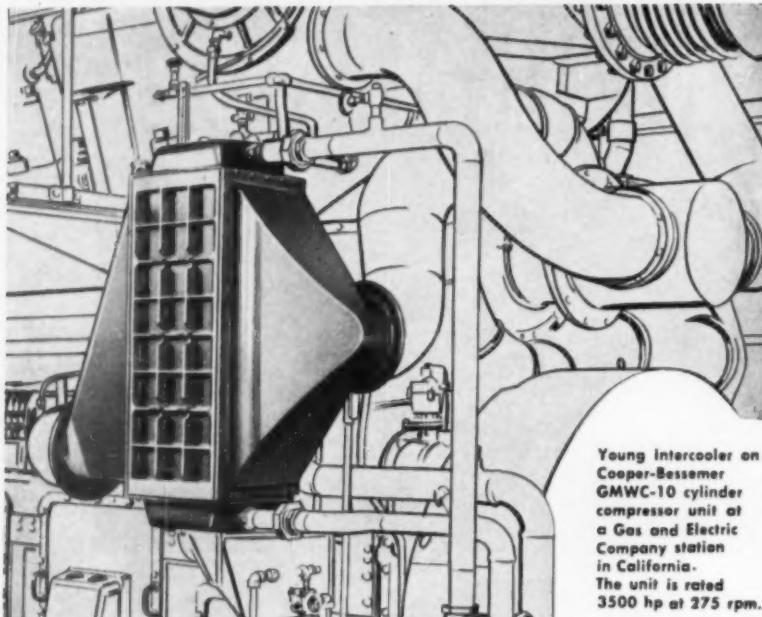
MICHIGAN Limestone Co. of Cedarville, Michigan has accepted delivery on a Hough model H-90 Payloader powered by a Cummins JN-6-BI diesel engine. Sale was made by Wolverine Tractor & Equipment Co. of Detroit and Grand Rapids.

EARLE Equipment Co. of Detroit has delivered a new Allis-Chalmers model HD11G tractor-shovel to Better Building Prod. of Benton Harbor. The unit will be broken in loading sand from a sand pit.

LAKEVIEW Excavating Co. of Mt. Clemens, Mich. has accepted delivery on a Hough model H-70 Payloader powered by a Cummins JF-6-BI diesel engine. Sale was made by Wolverine Tractor &

Young INTERCOOLERS

help get maximum efficiency from turbocharged engines

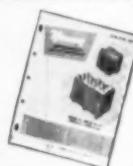


Young intercooler on Cooper-Bessemer GMWC-10 cylinder compressor unit at a Gas and Electric Company station in California. The unit is rated 3500 hp at 275 rpm.

Young engineering pays off with more power, more efficiency

Here is another specific example where quality and dependability count . . . Young gets the job. Many manufacturers in the Diesel industry look to Young Creative Heat Transfer Specialists for the product-answers to cooling problems. High and low pressure intercoolers by Young are used on stationary engines, marine engines, locomotives, oil pumping stations and natural gas compressors throughout the world. Young quality starts at the design of the intercooler cores themselves — laboratory tested and scientifically designed to furnish the maximum heat transfer with a minimum restriction of air flow. Intercoolers are only one of the many Heat Transfer products produced by Young. Why not put Young engineering to work for you — and solve your heat transfer problems now.

Write Dept. 409-M for Catalog 1652



Equipment Co. of Detroit and Grand Rapids.

EUCLID Division of General Motors has announced a new model C-6 tractor. Completely new in its design, the model C-6 has 211 net hp and a Torqmatic drive consisting of torque converter and semi-automatic transmission that eliminates the master clutch. Changes from one of the three forward speed ranges to another, and from forward to reverse and back again, are made under full engine power.

Mid-West Diesel News

By L. H. Houck

CENTRAL Excavating Co., Menomonee Falls, Wis., has installed one of the new GM 3-53 diesels in a $\frac{1}{2}$ cu. yd. Unit backhoe. Installation was made by Inland GM Diesel, Inc., Wisconsin distributor for Detroit Diesel engine division of General Motors.

W. HODGMAN & Sons, Inc., at Kenneth, Minn., road contractor in Minnesota, the Dakotas, Iowa, Wisconsin, Colorado, with a fleet of 12 International TD-24's, added wings to a dozer blade, increasing width to 13 ft. on a TD-24 used to feed firm's screening plant. Capacity was increased 25 per cent.

RYAN Equipment Co., St. Louis, will soon occupy its new building under construction at 3350 Morganford Rd., its present site. New structure will increase storage and parts department and sales and office departments. Thomas H. Ryan, president, established company in 1930. It now represents Marion, Allis-Chalmers, Austin-Western, Autocar trucks and other lines.

MOSS Construction Co., Chrisman, Ill., recently put a new 22-B Bucyrus-Erie dragline to work, powered with a GM 6-71 diesel.

LAKE SHORE Engineering Co., Chicago, installed a Deutz F2L712 air-cooled diesel on a Fairbanks-Morse pump.

MASSMAN Construction Co.'s towboat *Hank* launched this spring, built by Missouri Valley Steel Co., St. Louis, is operating as a work boat on the company's revetment work between Booneville and Kansas City. *Hank* is powered with two GM diesels, 607IE's, 170 hp at 1800 rpm. Propellers are Atlantic type, 3-blade, 36-in. diameter, engine is keel cooled. Maxim silencers are installed in stack.

INTERNATIONAL TD-6 with Drott loader to D. J. Huckie, Barnhart, Mo., for use in his contracting business, from Missouri-Illinois Tractor Co., St. Louis.

HUMBERT Summers, Benton, Ill., a model HUD Hough loader from Mo.-Ill. Tractor Co., St. Louis, with Hercules diesel and Hough torque converter.

RIVERVIEW Stone & Materials Co., Florissant, Mo., an Ingersoll-Rand 600 cfm Gyro-Flo air compressor powered with a GM 6-71 diesel from Mo.-Ill. Tractor Co., St. Louis.

J. & S. Sewer Contracting Co., Overland, Mo., two P & H Model 455C backhoes for ditch work, with P & H diesel engines. Sale by Mo.-Ill. Tractor Co., St. Louis.

OBSERVED: New International TD-20 crawler fitted with V-type Crossville cutter blade, owned by James Hughes, Brownsville, Tenn., and used near Arp, Tenn., to clear Mississippi bottom land for cotton planting.

HOUGH no. 90D Payloader, with Cummins diesel and Allison torque converter to St. Louis Slag Products Co., Inc., Granite City, Ill., from Mo.-Ill. Tractor Co., St. Louis.

COOPERATIVE Refinery Assn., Wichita, Kan., a A4L514 Deutz air-cooled diesel, for oil field work.

INTERNATIONAL TD-24 crawler to Western Paving Co., Denver, for stockpiling gravel at a new crusher operation, producing 1600 tons daily for use in oil mat road mix.

INTERNATIONAL model 65 Payhauler, for crushed rock hauling at plant of Walker Cut Stone Co., Milford, Kan. This unit and one other model 65 replaced a fleet of 6 highway type gasoline-engine powered trucks.

AL'S Excavating Co., recently put a new International TD-6 with Drott loader in service. Sale by Mo.-Ill. Tractor Co., St. Louis.

TRIANGLE Construction Co., Carbondale, Ill., with contract for 4-mile Route 146 approach to Mississippi river bridge across from Cape Girardeau, Mo., added a LeTourneau-Westinghouse model D Tournapull to its fleet with a Cummins diesel.

INTERNATIONAL TD-15 and Drott loader to Paul Sanget, Monsanto, Ill., from Mo.-Ill. Tractor Co., St. Louis.

PUBLIC Service Co., St. Louis, is expecting delivery of 50 new deluxe buses. An official said St. Louis is one of the first cities to have these new type buses made by General Motors. Engine is a V-6 GM diesel, buses have built in air conditioning, fluorescent lights, new Allison torque converters, buses haul 50

passengers. Cost is in excess of \$11/2 million.

Industrial Hose Catalog

A fully illustrated catalog containing 128 pages of specifications, technical data, sizes, descriptions, applications and installation instructions on Weatherhead hose and hose assemblies, brass and steel

tube fittings, hose and tube working tools, stock cabinets, hose racks and other specialty products is now available. This new catalog is designed to help users of hydraulic, air and fluid systems find the item needed with least waste of time and effort. Write to The Weatherhead Co., Fort Wayne Division, 128 West Washington Blvd., Fort Wayne, Ind.

ITS NEW

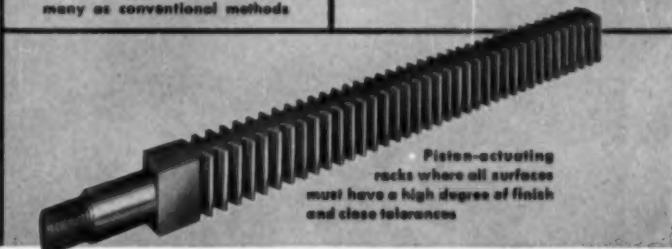
NOW-PRECISION RACKS

on a
Commercial Price basis



Typical spur pinion and rack. Short pieces as shown here can be cut two at a time with a single broach pass and not more than two passes. Longer racks require more cutting passes but not as many as conventional methods.

Heat treated alloy steel double racks 73" long overall 3 D.P., 6" face, for blast furnaces



Piston-actuating racks where all surfaces must have a high degree of finish and close tolerances

FINEST CUTTING MACHINERY AVAILABLE



Large surface grinder, 42" dia. wheel, for grinding rack blanks 10" x 17" x 64" long on all four sides within .002" square, flat and parallel before tooth cutting

Special precision, high production rack-cutting machine designed and built by BRAD FOOTE. Racks in illustration are used in precision glass-polishing machinery

We also have conventional rack-cutting equipment and manufacture racks of all sizes and shapes in single piece lots and smaller quantities where production tooling would not be required.

BRAD FOOTE makes any type of gear and speed reducers, transmissions and intricate power units. All are famous for long, satisfactory service. Why not discuss your requirements with our engineering staff, let us make recommendations or quote on your specifications. It can cost you much more to settle for less than BRAD FOOTE quality and service.



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Florida Diesel News

By Ed Dennis

CATS *Meow*, a 28x10 ft. steel yacht, built by Roamer Steel Boat Co. and powered by a pair of D320 Caterpillar marine diesel engines. Each develops a 130 max hp at 2400 rpm and has Capitol r&r gears. Its speed is 31 mph.

The *Meow* is expected in Florida waters the middle of November and Shelley Tractor & Equipment Co. of Miami will use it for demonstration purposes.

TRANS World Airways purchased several Leach Corp. diesel driven ground power units mounted on G. M. C. trucks. The 140 kva 115/200 volt, 3 phase 400 cycle generators are powered by a model

NHS 6BI Cummins diesel engine rated 290 max hp at 2100 rpm.

FLORIDA-Georgia Tractor Co. of Miami, sold the first model H120 Hough Payloader tractor-shovel in the State to Hollywood Quarries Inc. It is powered by a model NRT6BI Cummins 300 hp diesel and Allison 3.5:1 torque converter.

and a 30 ft. beam. For propulsion it has two D375 Caterpillar marine diesel engines plus two D315E Caterpillar diesel generating units. This 493 gross ton tanker will operate out of Trinidad, B. W. I.

GIBBS Corp. of Jacksonville launched a 240 ft. steel barge for the Morania Oil Tanker Corp. to transport hot asphalt in six coil equipped tanks total capacity of which is 21000 barrels. Two specially designed pumps, powered by Caterpillar D326 series F diesel engines, move the hot asphalt. The Cates are rated 200 hp at 2000 rpm.

MODEL 180 DLC, 4 cyl. Waukesha rated 31 hp at 1800 rpm, powers the 10 kw 115/230 ac Kohler generating set on William D. Pawley's new 46 ft. sportfisherman built at Chris Boat Yard. The *Flying Tiger* has two G. M. 6-71 inclined marine diesels with 2:1 Allison hydraulic r&r gears for propulsion.

WAUKESHA model VLRDBSU-V12 diesel engine powers the 500 kw generator at the new Bomarc missile station near Tarpon Springs. The generator is by Electric Machinery.

C. T. STOCKTON took delivery of two Galion #160 rollers powered with model 282 International (95 hp at 1800 rpm) diesel engines and Allison torque converters and two model TD15 International crawler dozers with International 105 net hp diesel engines from Florida Georgia Tractor Co., Miami.

NEFF Machinery Inc. supplied the two Chicago Pneumatic air compressors powered by General Motors 6-71 diesel engines. These two units are teamed up with a pair of Manitowoc cranes being used for pile driving by the Thornton Construction Co. of Fort Lauderdale.

WATCHED a pair of T55 International Payscrapers (14 cu. yd.) powered by a model HRB600 Cummins 172 hp diesel engine, Fuller transmission, 17 in. Lipe-Rollway single plate clutch owned by Dupre-Williams Construction Co. of Tampa, clearing a site for a shopping center. A T. D. 14A and a T. D. 18 International crawler dozers assisted the scrapers.

CENTRAL of Georgia Railroad Co. took delivery of a new Kershaw ballast regulator for its track maintenance operation at Daneville, Ala. The track sweeper is powered by a General Motors 4-53 diesel (82 bhp at 2200 rpm) which drives through a Funk reduction power take-off.

MAIN pumping station at Florida City of the Florida Keys Aqueduct Comm. has two Fairbanks-Morse pumping units. Both are model 32E14, the 6 cyl. is rated 450 hp and the 4 cyl. is rated 380 hp, both use Commercial oil purifiers.

THE West India Shipping Co.'s new tanker *Inagua Tern* has a 193 ft. length

and a 30 ft. beam. For propulsion it has two D375 Caterpillar marine diesel engines plus two D315E Caterpillar diesel generating units. This 493 gross ton tanker will operate out of Trinidad, B. W. I.

NEAR Lamont, the H. E. Wolfe Construction Co., is using a fleet of three model 210 Michigan scrapers powered by model NTO-6BI Cummins, 262 hp, diesel engines and Clark 3.0:1 torque converters to help move 267,475 cu. yds. of borrow fill for road construction work on State Highways 19 and 27. A Michigan #280 tractor dozer was being used to push load and had a similar power unit.

MARILEEN, a 65x16x4.7 yacht, skippered by Capt. R. G. Comstock docks at Bal Harbor. It is powered by a pair of G.M. 6-71 marine diesel engines with 2:1 Allison hydraulic r&r gears which turn 30X24 Columbian propellers. The six kw generator is also dieselize. All three diesel engines have Maxim exhaust mufflers.

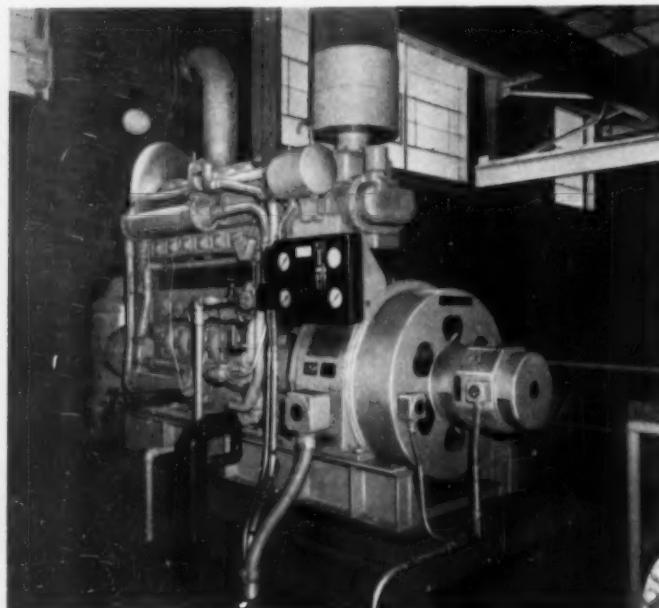
AT Tampa, the Jos. L. Rozier Machinery Co. supplied the J. W. Conners Construction Co. with two new Caterpillar DW21 scrapers, for a total fleet of five. These two wheel tractors are powered with 6 cyl. turbocharged 300 hp Caterpillar diesel engines. The #470 scrapers have a 25 cu. yd. heaped capacity.

TOPOSCATTER Building at Horsehoe Beach, received two 50 kw Waukesha Enginator sets. These are powered by model 135DKB Waukesha 6 cyl. 4 1/4 x 5 diesel engines and are rated 113 hp at 1800 rpm and have Electric Machinery generators. The sets came from Simplex Sales, Miami.

AT the Municipal Airport, Orlando, the Hubbard Construction Co. has dozens of dieselize earth moving equipment working. A partial list includes, a TS24 Euclid twin power scraper with

Picture of O-P economy!

Ohio pumping station saves \$300 a month using F-M Opposed-Piston standby diesel for both power generation and pumping



Compact, lightweight Model 38F5 1/4 O-P is rated 450 hp. at 1200 rpm., direct drives a 175-kw. F-M alternator and, through right-angle gears, an F-M Pomona Vertical Turbine Pump with 5.5 mgd. capacity at discharge pressure of 105 psi.

Electric power off the flywheel end, high-service pumping off the front—that's the standby job cut out for this Model 38F5 1/4 Fairbanks-Morse O-P Diesel in the Elyria, Ohio water works serving 60,000 people.

Called into service for 3 to 6 hours a day in the Spring of 1958, the O-P pumped water for \$1.50 less per million gallons than purchased power—a \$300 per month reduction, including savings on demand charges. Each Saturday the engine makes a test run as

the sole high-service on the line.

Versatile as well as economical, the Model 38F5 1/4 O-P is also ideal for direct-driving other equipment off the rear, with front end of shaft driving an auxiliary generator, crusher, pump, etc. The O-P can be furnished for either diesel, dual-fuel, or spark-ignited operation, and is available as a complete packaged unit with all accessories attached to the frame. Write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.



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a name worth remembering when you want the BEST

DIESEL, DUAL FUEL AND GAS ENGINES • LOCOMOTIVES • ELECTRIC MOTORS • GENERATORS
PUMPS • SCALES • COMPRESSORS • MAGNETOS • HOME WATER SYSTEMS

a G. M. 6-110 and a 6-71 for a total of 518 hp and Allison torque converters; and an S12 Euclid scraper assisted by two model C Le Tourneau-Westinghouse Tournapulls. These also have General Motors 210 hp series 71 diesel engines for power.

MODERN Diesel Power Co. of Tampa supplied the 4 cyl. model X 220 cu. in. Ford marine diesel engine for the 22X10 in. ft. dredge tender owned by the Hendry Corp. It has Capitol 2:1 hydraulic r&g gears.

FORT Myers Dredging Cos. 40 ft. dredge *Credland* is using a twin G. M. 6-71 diesel for power for the 12X10 in. Kansas City sand pump plus a 60 kw 440 volt Delco generating set that is powered by a 6 cyl. series 71 165 hp G. M. diesel.

Caterpillar to Consolidate Some Operations

Caterpillar Tractor Co. has announced that it will consolidate its domestic sales, parts, service and treasury operations in Jan., 1960. Nineteen men of the Company's northwest and southwest divisions will occupy offices at Peoria. They currently are headquartered in San Francisco. "Departments involved in the moves will gain better communication by having their people centrally located at Peoria," Vice President W. K. Cox said. The advent of seven-hour air service will allow these people to continue to spend adequate time in the field, Cox commented. All northwest and southwest division field and district representatives will continue to work in their present locations.

Burgess-Manning Appoints Canadian Sales Representatives

To more efficiently and adequately handle the increasing demand for industrial silencers and pulsation snubbers, Burgess-Manning Co. has recently appointed the following sales representatives: Bass Industrial Equipment of Canada, Ltd. 214 Merton St., Toronto, Ontario for the Province of Ontario west of the 77th meridian; Assoc. Instrumentation & Controls Ltd. 2655 Bates Rd.; Montreal, Quebec for the Provinces of Quebec and Ontario east of the 77th meridian; and Belen-Lynn McGuffey Co., Ltd.; P.O. Box 691 Calgary, Alberta and P.O. Box 635, Edmonton, Alberta for the Provinces of Alberta, Saskatchewan and Manitoba. The companies appointed will handle all sales matters in their respective territories. Inquiries for general information should be forwarded to the Dallas, Tex., headquarters of Industrial Silencer Division of Burgess-Manning Co., 9207 Sovereign Row, Dallas 35, Tex.

Lamberth, Woltz Promoted

Promotion of Tom M. Lamberth, Jr. to the post of assistant to Southwest district manager is announced by George Edick, domestic sales manager of The Cooper-Bessemer Corporation. Simultaneously, Clifton W. Woltz has been appointed branch manager of the Cooper-Bessemer Shreveport office. Formerly branch manager of the Shreveport office, Lamberth will work under the direction of C. Horace Sanders, Southwest district manager, at the Cooper-Bessemer office in Dallas, Tex. In this capacity, he will be responsible for directing the application engineering and sale of engine-driven and motor-driven compressors, diesel, gas-diesel and spark-ignited gas engines. Mr. Woltz had been sales engineer at the Cooper-Bessemer Dallas office before his promotion to branch manager of the company's Shreveport office. A graduate of the Case Institute of Technology, he holds a B. S. degree in mechanical engineering.

Bulletins on Fuels

New bulletins on use of fuels for diesel engines have been issued by Enterprise Engine & Machinery Co. "The Efficient Use of Heavy Fuels With Enterprise Engines" presents an illustrated description of a typical heavy fuel system. The six-page folder defines heavy fuels and explains how it is possible to burn them in diesel engines, resulting in more economical power. The heavy fuel system may be used in stationary power plants and marine installations. Also described is the Enterprise dual fuel system which permits these diesels to burn gaseous fuels, including natural gas and sewage gas, as well as diesel oil. The bulletins can be obtained by writing Enterprise Engine & Machinery Co., 18th and Florida Sts., San Francisco, Calif.

ITS NEW

100,000th Torqmatic Built

The Allison Division of General Motors Corp. recently completed assembly of its 100,000th commercial Torqmatic transmission at its plant in Indianapolis. Commercial Torqmatic transmissions have been in production since 1945 and are now in use in many types of equipment in construction, earth-moving, mining, materials handling, logging, transportation, marine and hauling industries. Military applications have been in production since 1945.

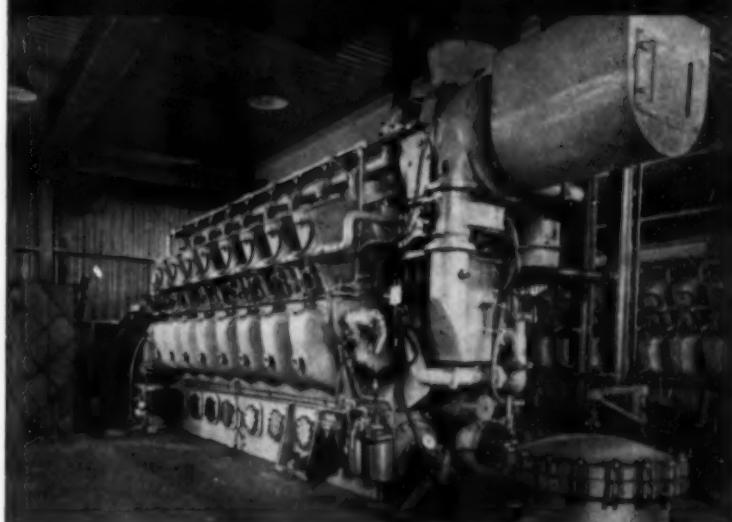
Firm Buys 39 Diesels

Strickland Transportation Company has recently taken delivery of 182 International trucks at a cost of more than \$1.5 million as part of a fleet modernization

and expansion program. The new trucks will be used throughout the Strickland system, which serves a territory ranging from Texas to New York and includes such points as Little Rock, Memphis, St. Louis, Cleveland and Philadelphia. Headquarters of the firm are at Dallas, Tex. Of the total trucks purchased, 136 are International tractor models designed for highway hauling service. The

remaining 46 are compact-design straight trucks equipped for city pickup and delivery service. Thirty-nine of the highway tractors are diesel-powered DCOT-405 cab-over-engine models rated at 76,800 lbs. gross combination weight. They are equipped with 195 hp Cummins NH-195 diesel engines, ten-speed Road-Ranger transmissions and single-tire pusher axles with V-belt drive.

THESE ENGINES EQUIPPED WITH
NUGENT FILTERS
have operated over 18 months
without changing lube oil
or filter cartridges



"These Alco 251 Diesels, equipped with Nugent Full-Flow Filters, have operated over 18 months without changing lube oil or filter cartridges."

This report from the Laton (Kansas) Pumping Station of Service Pipe Line Company is further positive proof of the dependability and economy of Nugent Filters.

The filters employed at Laton are Nugent's Fig. 1555 Laminated Fiber Disc Type. They filter all the lube oil in circulation every cycle before it goes to the bearings. Foreign particles as small as 2 or 3 microns are removed... oil is kept cleaner... oil life is actually extended.

The service life of your valuable equipment can be materially lengthened by providing the best filtering protection available. This is the business of the Nugent Co. Write for descriptive literature, today.



Nugent Fig. 1555 Filter Cartridges remove microscopic size foreign solids.



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OIL FILTERS • STRAINERS • TELESCOPIC OILERS
OILING AND FILTERING SYSTEMS • OILING DEVICES
SIGHT FEED VALVES • FLOW INDICATORS

Awarded Nike-Zeus Contract

Electric Machinery Mfg. Co., has received a contract for four large electric generators and switchgear. A. P. Burris, E-M president, who announced the new contract, put its worth at \$750,000. Cooper Bessemer Corp., manufacturer of the diesel engines which will drive the generators, placed the contract with E-M. The engine-generator sets will be part of the new Nike-Zeus, anti-missile defense system. The E-M generators are rated 1500 kw each, at 327 rpm. Included is an excitation and voltage regulating system which has no moving parts. The operating characteristics of the machines are unique and must meet exacting requirements. Typical of these is a computer dynamic analysis of the complete engine-generator set. The four units comprise a test power plant which will supply the electrical energy needed for the Zeus search radar stations. The Nike-Zeus system will seek out, identify

and destroy enemy inter-continental ballistic missiles in flight. E-M has supplied the 400 cycle motor-generator sets for the Nike-Hercules system. Over one thousand of these units have been shipped to date.

Alpha Engine in British-Built Coaster

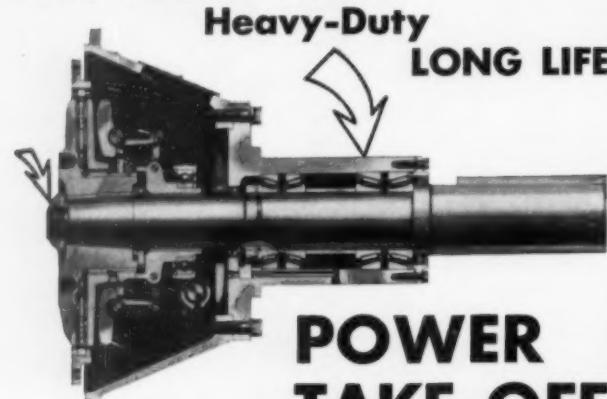
In Great Britain the cargo motorship *Glenshiel* has been delivered from Livingston & Company's yard at Peterhead, Scotland, after successful trials. The new ship is of a popular British coaster design normally described as a "Clyde Coaster", and apart from being the first B&W Alpha powered British coaster, the *Glenshiel* is also among the first ship of this type in Britain to be equipped with controllable pitch propeller. Throughout the trials the engine, rated 280/310 bhp at 375 rpm performed without a hitch, and a mean speed of 9.35 knots was obtained in ballasted condition.

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CLUTCHES

New Gerin Oil Condition Indicator

The Gerin Corporation of Avon, N. J., has announced a new model of its oil condition indicating meter which serves all engines—gas, gasoline, and diesel. Model DG replaces model D which was used for diesels. The Indicator is a gauge type meter which reveals at a glance the condition of the engine oil, and tells whether it is time to change oil or filter. It also shows up fuel or water leakage. The meter responds, exclusively, to changes in the oil due to contamination by dilution, water, running on dead filters, etc., because winter or summer, it is not affected by variations in crankcase temperature. Model DG meter is easily read when the engine is stopped because the meter pointer remains on reading position. This convenience permits a man checking the dipstick level or inspecting the engine, to also tell at a glance the condition of the oil. He does not have to start the engine. Earlier models of Gerin oil condition meters were first put on the market in November, 1954 as a later development over oil inspection kits. A meter has the advantage of enabling a reading on the oil condition every day, without drawing samples from the engine, requiring no labor and no particular skill. Available is free illustrated bulletin No. 950.

ITS NEW

New Universal Electric Plant Price List

A new eight-page price list covering its complete line of diesel electric plants has just been issued by Universal of Oshkosh. The new price list has been completely revamped and expanded. Many new models have been added to the Universal line particularly in the larger sizes. Standard models are now being offered up to 60 kw. Numerous price reductions are effective with this new price list and it has been laid out for greater convenience. Many accessories and extra equipment items have been added. Copies of the new Universal price list, form SE-18, can be obtained direct from the Universal Motor Co., 511 Universal Drive, Oshkosh, Wis.

ITS NEW

Briggs Filtration Co. Adds Owings to Staff

Appointment of Mr. Kenneth B. Owings to its research and development staff has been announced by The Briggs Filtration Co., Washington, D.C. Owings had been associated for 12 years with Tidewater Oil Co., where he handled field testing and development work on fuels and lubricants. With Briggs, he will be project engineer in charge of research and development of diesel and industrial lubricating oil filtration.

Denver Plant for GM Sales and Service

A new \$100,000 plant for the sale and service of GM diesels in Denver, Col., was opened officially last month when Dobbs GM Diesel, Inc., held a three-day open house for government officials and representatives of the construction, trucking, petroleum, lumbering and mining industries operating in the area. The company with O. L. "Larry" Dobbs as president assumed the GM diesel distributorship in Dec., 1958, but official announcement was withheld until the new facilities were completed. Dobbs formerly operated the GM diesel dealership at Fort Morgan, Col. Branches are presently operated at Fort Morgan and at Casper, Wyo. Associated with the company are Dick Jeffries as sales manager; Glenn Donaldson as parts manager; and Earl Goble as service manager. All have had extensive experience in the application and servicing of diesel units in trucks and in all other types of equipment.

New Hercules Bulletins

A new two-page bulletin with half-page fold-out flaps has been issued by Hercules Motors Corp., describing Hercules 3-cylinder closed and open diesel units. Bulletin no. P. U. 506 describes the DD-169 direct-injection diesel units, which develop up to 46 hp at 2000 rpm. Copies may be obtained by writing Hercules Motors Corp., 101 11th Street, S.E., Canton 2, Ohio.

ITS NEW

GM Diesel Awards Guild Memberships

Service staff members of Holman GM Diesel of Billings, Mont., and Williams and Lane, Inc., of Berkeley, Calif., were honored after qualifying for membership in the GM Detroit Diesel's Service Craftsman's Guild. The Guild is a national organization established this year by the GM Division to recognize and encourage expert workmanship in the proper servicing and maintenance of GM Diesel engines. To qualify the men passed a rigorous examination conducted by field service engineers of GM Diesel's regional offices. At Berkeley, a Guild membership plaque in recognition of the entire qualifying group was awarded to Jack Jones, service manager of Williams and Lane. Qualifying for membership were Charles E. Durand, Carl Peters, Russell L. Strain, William C. Wilde, Everett Dawson and Harold G. Hamilton. Memberships were awarded at Billings to Raymond B. Jones, Wendell V. Jones, and Lawrence H. Ross. Wendell Jones, service manager of Holman, also accepted a Guild membership plaque recognizing the entire group. Awards were presented by James

Thornton, regional service manager of GM Diesel's San Francisco office. Representing GM Diesel at award dinners, in addition to Thornton were C. B. Clum, general service manager of Detroit, and R. L. Burpee, manager of the Western region.

Fidelity Regulator Bulletins

Three new bulletins on voltage regulators for ac generators and generator exciters have been published by Fidelity Instrument Corp. Bulletin 3200 describes the firm's model F-26 regulator series; bulletin 3210 gives operation and maintenance instructions for that series while bulletin 3300 describes the model F-33 series and gives operating and maintenance instructions. The bulletins can be obtained by writing Fidelity at 1000 E. Boundary Ave., York, Penn.

ITS NEW

Kysor Creates New Position

James B. Kearney, who has been a Kysor field engineer for five years and service manager for one year, was promoted to assistant to sales manager, O.E.M. Sales. The growing standardization of Kysor shutters by truck manufacturers has created the need for a direct O.E.M.-Kysor relationship. Kearney will be "home based" at Kysor, Cadillac, Mich. Filling Kearney's position as service manager is Donovan D. McConville, who has been with Kysor for 18 years in a production supervisory capacity.

Gets Navy Order

Solar Aircraft Co. has received recent orders totaling more than \$1½ million for its Mars, Jupiter and Saturn gas turbine engines, Herbert Kunzel, Solar president, announced. The U.S. Navy ordered 80 Mars gas turbine pumper units and spare parts for general fleet use. The turbine-driven portable pumper units are designed for shipboard fire fighting. Two of Solar's new 1100 hp Saturn gas turbine engines were purchased by the Navy for installation as propulsion units on an advanced air-sea rescue boat. The boat will have twin gas turbines with each engine driving a propeller. Also included in the orders was one for eight Solar Jupiter 500 hp gas turbine engines which will go into West German Navy minesweepers. The turbine engines will drive electric generators in the ships.

Allis-Chalmers Announces New Tractor Series

A new line of tractors for utility and industrial jobs has been announced by the Allis-Chalmers Co. The new "D" series "D-17" unit is powered by a 6 cylinder Allis-Chalmers diesel engine rated at

53.43 hp at 1650 rpm. Among accessories for the line is a new hydraulic implement lift control. Brochures on the new line can be obtained by writing the company at Milwaukee 1, Wis., and asking for brochures UT-103 and TL-2026.

ITS NEW

New Onan Electric Plant Catalog

Onan's recently-added line of high-capacity electric generating plants is described and illustrated in a new 1960 general catalog just released. Catalog F-146 is a 2 color, 8 page folder listing more than 45 basic models of Onan engine-driven generator sets. Each series of plants is described in detail, with specifications for both engine and generator. A chart of representative models within each series outlines details as capacity of the plant, model number, voltage, starting method, dimensions and weight. Optional accessories for each series of generating plants are also illustrated. The new 1960 Onan electric plant catalog F-146 is available by writing the manufacturer, D. W. Onan & Sons Inc., 2515 University Avenue S. E., Minneapolis 14, Minnesota.

ITS NEW

Turbine Starter for B-58

Pneumatic starting of the supersonic B-58 bomber will be provided by an AiResearch trailer mounted gas turbine compressor according to an announcement this week by Convair Fort Worth, manufacturer of the delta winged "Hustler." A wing quantity of the AiResearch turbines are being purchased by Convair for ground support of the B-58. AiResearch model 105 gas turbine will start two of the Hustler's J-79 main engines simultaneously in less than 30 seconds. All four of the engines are started in less than one minute. Use of the ground unit for starting the four engines two by two is faster and more economical than cross bleeding air from a started engine, according to AiResearch. The model 105 turbine is the most powerful gas turbine yet produced by The Garrett Corporation's AiResearch Phoenix division. Producing 210 pounds of air flow per minute the new turbine supplies pressures of 75 psia. In a shaft power configuration the turbine can produce 850 hp though weighing a little more than 300 pounds.

Spark Arrestor Data Sheets

Data sheets describing its line of spark arrestor silencers are available from the Maxim Division of the Emhart Mfg. Co. The publications describe seven different models of silencer arrestors for varying applications where exhaust noise must effectively silenced and complete elimination of hazards from flying sparks must be achieved. In the spark arrestor

silencers carbon particles and sparks are separated from the exhaust gas by centrifugal force which whirls them to the side of the chamber where they drop to the bottom of the silencer and may be collected in a removable spark box. The units are designed for either horizontal or vertical installation and models come in various sizes to fit requirements of specific installations. The bulletins on spark arrestor silencers can be obtained by writing the Maxim Division, Emhart Mfg. Co., Hartford 1, Conn.

Names Texas Representative

Appointment of The Eads Co. as its factory representative in Texas has been announced by The Air-Maze Corp. The Eads Co. will handle the application and sale of the Air-Maze industrial line of air and liquid filters, including filters for the gas transmission and petroleum processing industries. Eads has offices in Houston and Dallas.

Cooper-Bessemer to Purchase Rotor Tool

Announcement of the proposed purchase of the assets of The Rotor Tool Co., of Cleveland by The Cooper-Bessemer Corp., has been announced by E. L. Miller, president of Cooper-Bessemer, subject to approval of the move by shareholders of the present Rotor Tool at their shareholders' meeting. It is planned that Roto Tool's business will be carried on by a wholly-owned subsidiary of Cooper-Bessemer, having the same name, Rotor Tool Co. No changes are contemplated in the company's present management or location of plant facilities. Mr. Herbert P. Bailey, president of Rotor Tool, is to remain in that position, and will become a member of the Cooper-Bessemer board of directors when the purchase transaction is completed. Mr. Miller and other Cooper-Bessemer executives will, in turn, serve on the new Rotor Tool board.



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Three Managers Named



H. E. Hanson

Three experts in the manufacture and selling of heavy industrial products were appointed to the team of managers for the Beloit Division, largest segment of Fairbanks, Morse & Co. Gordon R. Anderson, vice president and general manager of the Beloit Division, named

these men: Paul Flood, to be general manager of the large machinery division, H. E. Hanson, to be general manager of the diesel, compressor, and



Clay Armstrong



Paul Flood

locomotive division and Clay Armstrong, to be general manager of the magneto and engine accessory division. "These men have the experience and knowledge which we count on to strengthen the company in its new period of modernization," Mr. Anderson said. "The three men who have just

been appointed to the chief offices in the Beloit Division have been given a combination of responsibilities that have been kept separate in the past. Control over manufacture and sales is now fixed in one organization." Flood, who supervised the construction of a high proportion of the submarine engines used by the United States Navy during World War II, has been with Fairbanks-Morse as an industrial engineer in Beloit since 1940. He was born in Rockford, Ill., and lives in South Beloit, Ill. Hanson, an engineer who started with Fairbanks-Morse as a draftsman in 1934, advanced to the position of branch manager in St. Paul, Minn., before his most recent promotion. He is moving to Beloit from St. Paul with his family. He has eight children. In St. Paul he was secretary of the Rotary Club last year. Armstrong, who is being promoted from the position of sales manager of the Magneto Division, joined Fairbanks-Morse when it purchased Armstrong Products Co., Milwaukee, in 1958.

AiResearch Turbochargers Installed on Continental Motors' TD 427 Diesel Engine

An order for a sizable quantity of small turbochargers has been shipped by The Garrett Corporation's AiResearch Industrial Division to Continental Motors Corporation. The turbochargers are being installed on Continental's Model TD 427 diesel engine to compensate for altitude effect on sea level horsepower rating. At 1800 rpm, with all accessories the six-cylinder TD 427 is rated approximately 110 bhp. With the air supplied by AiResearch's exhaustdriven unit, the engine holds to approximately that figure to an altitude of 10,000 ft. Without the AiResearch turbocharger, decreasing density of ambient air reduces horsepower of the engine to as low as 80 bhp at 10,000 ft. AiResearch's turbocharger model TO704, used in this application, weighs just 24 lbs. and measures a little more than 7 in. in diameter.

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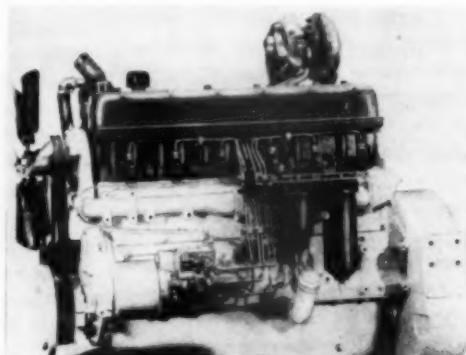
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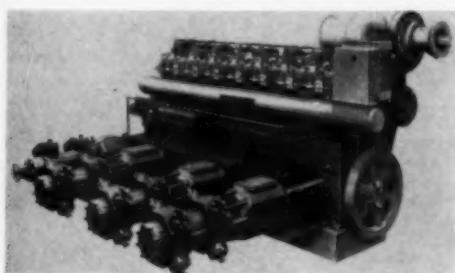


View of Continental Motors' Model TD 427 diesel engine with AiResearch turbocharger installed.

Clark Redesigns HRA-T Line of Compressors

Turbocharging plus new, heavy duty construction have been incorporated in the new, redesigned Clark line of HRA-T gas engine-driven compressors. The new series was built for the intermediate horsepower range. All vital parts, including the crankcase, bed section, pistons, crossheads and running gear, have been made larger and stronger. The Clark-designed turbocharger is jet air started and completely self-sustaining at normal operating speeds. The turbocharger is closely matched to the

operating characteristics of the engine. Scavenging cylinders are completely eliminated.



Power pistons are of the 2 piece, skirt and hanger type, precision ground and parco-lubrized. The heavy lower crankcase is of cast semi-steel, accurately bored for precision main bearings. Additional ribbing is provided in the main bearing support bridges.

With 14 x 14 in. bore and stroke, the HRA-T is built in four, five, six and eight power cylinder models with from 660 to 1320 bhp. Two, three and four horizontal compressor cylinders are used, depending on model and applications. Two companion non-turbocharged units, rated 750 and 1000 bhp, also are available. Write Clark Bros. Co., Olean, N.Y., for additional information.

**Brooks Appointed Service
Manager of Lucas C.A.V. Division**

Appointment of A. A. "Tony" Brooks as Service Manager of its C.A.V. Division is announced by Lucas Electrical Services Inc. Mr. Brooks will headquarter at the Lucas Head Office, 501 W. 42nd St. New York City. Prior to this assignment Brooks was stationed in Bombay, India with Lucas Indian Service Ltd. as C.A.V. Service Manager. Mr. Brooks joined the C.A.V. organization in his native London in 1945. He was brought into industry with British, Thompson & Houston Co., Ltd. with whom he served his engineering apprenticeship. He is a graduate of the Acton Technical College, London. In his new capacity Brooks will be responsible for C.A.V. service throughout the U.S. and will also serve in expanding dealer-distributor relationships.



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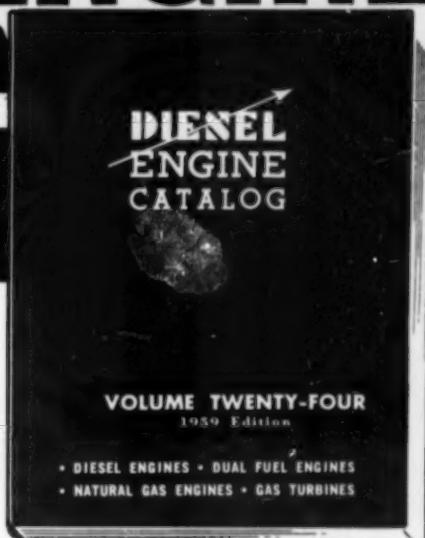


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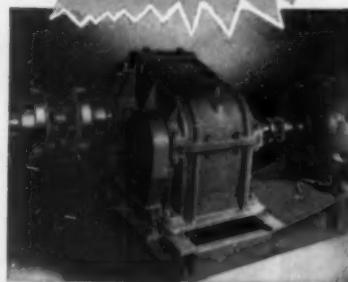
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The Engineer's Field Report

CASE HISTORY

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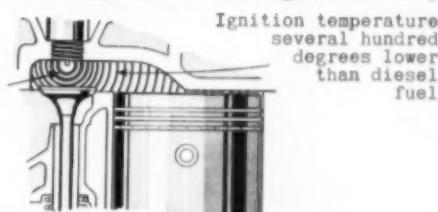
GREAT NORTHERN RAILWAY'S 250-TON, RAILROAD CRANE (above) starts instantly with Chevron Starting Fluid in temperatures ranging to 50° below zero—even after standing idle for months at a time. Former steam-powered wrecker equipment took crew 12 hours to start. This crane with its two 174 h.p. Cummins diesel engines is now available for derailment emergencies on short notice.

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these engines 'right now'—in any weather." A Great Northern engineer shows how simple it is to insert 7CC gelatin capsule of Chevron Starting Fluid in unit's air-intake system. Fluid is also available in 17CC capsules and 1-pint cans.

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John Parris, Manager Centrifugal Compressor Sales, and John Fullemann, Chief Turboproduct Design Engineer, The Cooper-Bessemer Corporation, discuss...

How Cooper-Bessemer blowers assure dependable sewage aeration

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